# SURVEY OF POSTURAL DEFORMITIES OF LUCKNOW SCHOOL GOING CHILDRENS IN RELATION TO MINIMAL STRENGTH



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By

**SHSAHI KANAUJIA**

Under the Supervision of

**DR. R.P. JHA**
( Head )

DEPARTMENT OF PHYSICAL EDUCATION
BUNDELKHAND UNIVERSITY, JHANSI
INDIA

**2007**

# CERTIFICATE

This is to certify that MISS SHASHI KANAUJIA has written the thesis on "**SURVEY OF POSTURAL DEFORMITIES OF LUCKNOW SCHOOL GOING CHILDREN IN RELATION TO MINIMAL STRENGTH**" under my guidance and supervision. The research work, done by Miss Shashi Kanaujia, is her original work, done by her ownself.

Dated: 23.4.2007

(Dr. R.P. Jha)
Supervisor

## CERTIFICATE

(a) The thesis fulfills the requirements of the ordinance related to Ph.D. Degree of the Bundelkhand University, Jhansi.

(b) Miss Shashi Kanaujia, worked under my supervision for the required period as per Para 8(a) of the ordinance.

(c) The thesis is satisfactory from the point of language and presentation of subject matter.

The thesis on **"SURVEY OF POSTURAL DEFORMITIES OF LUCKNOW SCHOOL GOING CHILDREN IN RELATION TO MINIMAL STRENGTH"** is forwarded for evaluation to the University.

Approved

(Dr. R.P. Jha)
Supervisor

## DECLARATION

I hereby declare that the research done on the topic **"SURVEY OF POSTURAL DEFORMITIES OF LUCKNOW SCHOOL GOING CHILDREN IN RELATION TO MINIMAL STRENGTH"** is my original work. I have specified by means of references the sources from where the information has been taken.

To the best of my knowledge this thesis is not substantially the same which might have already been submitted for a degree or any other academic qualification at any other university, on the subject.

Dated: 23/4/2007

(Miss Shashi Kanaujia)
Research Scholar
Bundelkhand University, Jhansi.

**TO MY BELOVED**
**PARENTS, BROTHERS, SISTERS,**
**WHO CONTRIBUTED THE MOST OF**
**MY LIFE EVER RESPECTED GUIDE FOR HER**
**CONSTANT SUPPORT AND ENCOURAGEMENT**

# VITA

| | | |
|---|---|---|
| 1. **NAME** | : | **SHASHI KANAUJIA** |
| 2. **PLACE OF BIRTH** | : | KANPUR, INDIA |
| 3. **DATE OF BIRTH** | : | 25th March, 1975 |

**GRADUATE AND POST-GRADUATE INSTITUTION ATTENDED:**

Lakshmibai National Institute of Physical Education, Gwalior, Madhya Pradesh.

**DEGREE AND DIPLOMA AWARDED:**

Bachelor of Physical Education, 1998, Lakshmibai National Institute of Physical Education, Gwalior, INDIA

Master of Physical Education, 2000, Lakshmibai National Institute of Physical Education, Gwalior, INDIA

National Education Test (NET), 1999-2000, University Grant Commission (UGC), New Delhi.

**AREA OF SPECIALIZATION:**

*BASKETBALL*

**AREAS OF TEACHING INTEREST:**

Teaching and coaching in basketball

Officiating in basketball.

Teaching and coaching in Kho-Kho and Handball.

Measurement in Physical Education

Sports Management.

Sports Bio-Mechanics.

Health Education.

## VITA (Continued)

**SPORTS ACHIEVEMENT:**

Participated in the K.V.S. Regional Sports Meet in **Volleyball** in the year **1993-1994.**

Represented Gwalior District Team in the **M.P. State Level Women's Games and Sports** Competition in the year **1995.**

Participated in the South-West Zone Inter-University **KHO-KHO** competition in the year **1996.**

Participated in the South-West Zone Inter-University **Basketball** competition in the year **1997.**

Participated in the South-West Zone Inter-University **Handball** competition in the year **1997.**

Participated in the All India Inter-University **Handball** competition in the year **1997.**

Participated in the South-West Zone Inter-University **Basketball** competition as Captain in the year **1999.**

**PROFESSIONAL EXPERIENCE:**

Acted as an **official** in South-West Zone and All India Interversity Basketball Champion-ship for men's in the year **1998** held at Gwalior.

Acted as an **official** in All India Interversity Athletic Championship held at L.N.I.P.E., Gwalior in January, **2000**.

Lecturar in Physical Education, 2003 onwards, Lucknow University, Lucknow.

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# TABLE OF CONTENTS

## TABLE OF CONTENTS (continued)

# LIST OF TABLES

# LIST OF ILLUSTRATIONS

## LIST OF ILLUSTRATIONS (continued)

## LIST OF ILLUSTRATIONS (continued)

## LIST OF ILLUSTRATIONS (continued)

## LIST OF ILLUSTRATIONS (continued)

## LIST OF ILLUSTRATIONS (continued)

Chapter I

# INTRODUCTION

The erect posture is a unique characteristic of a man which distinguishes him from the rest of the animals. For which un-matching peculiarity of human posture, it has correctly been said, "without man's posture no man, without man no culture, without culture, a world not work living in"[1]

**"Child is the father of man"**

This is what an English Poet has said. Therefore, good habits are essentially the base for good health. Health needs better structure and vice-versa. Posture is the index of personality. Good habits help to develop good posture. The early childhood and adolescent years in the life of an individual are crucial stages in the process of his growth and development. This is the period when a child is more impressionable and is most eager and ready to learn. It is, therefore, essential to provide him with necessary opportunities early in life for normal development of his mind, his body in relationship to others. Parents exert a profound influence in the development of the child, particularly during the early stages of his development. They transmit their own behaviour codes, attitudes and values to their offspring's. The immediate members of the family, the siblings and the peer groups also influence the learning process of the child. Once a child enters school, hit gets exposed to systematically design learning

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[1] *Oscar W.Kiputh et al, "Postural Defects" (London: W.B. Saunders Company, 1946), p.1*

experience, which are based on a prescribed curriculum designed to facilitate all attainment of certain educational goals and objectives. All educational activities are directed to enable a child to discover his talents, sharpen his abilities and faculties, develop his physical and intellectional potentialities and propensities to the fullest, develop his social skills and foster his emotional well being.

Healthy children and healthy families are essential for human and national development. For the well being of the children it had been recognized that ill health and poor nutrition are violations of the child's most basic right to survive and to develop normally in mind and body.[2]

Posture as an aspect of physical fitness, has an enormous popular and scientific literature. Postural "slump" indicates fatigue or poor condition and may be viewed as a barometer of muscular tone.[3]

There are innumerable concepts of human posture and innumerable interpretations of its significance. Posture may well claim to be "all things to all men." To the physical anthropologist posture may be a racial characteristic, or it may be an indication of phylogenetic development; to the orthopedic surgeon it may be an indication of the soundness of the skeletal frame work and muscular

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[2]*James P. Grant, "The State of the Word's Children 10089,"* UNICEF *(December 1989) : 11.*

[3]*Thomas K. Cureton Jr., "Bodily Posture as an Indicator of fitness,"* Research Quarterly *12:2 (May 1941) : 362.*

system; to an artist it may be an expression of personality and emotions; to the actor it serves as a tool for expressing mood or character; to the physician, the biologist, the fashion model, the employer, the sculptor, the dancer, the phychologist – to each of these, posture has a different significance. Each sees posture within the frame work of his own profession and interest.[4]

Erect posture is commonly associated with attitude of readiness, self-confidence and assurance. A relaxed or slouched posture may generally connote laziness and incompetence. For this reason the erect posture is the one most often aspired to and considered normal. Certainly erect posture gives a better appearance since clothes fit better; the physique is shown to better advantage and the face is held up so that an expression of attentiveness is indicated. Fashion models, stage and screen actresses, and beauty contest winners' assume erect and stately posture in order to appear to the best advantage before an audience.

A well-conditioned body makes possible good posture, the emotional concomitants of which might well be self respect, pride, self-confidence and courage. Weak muscles, poor posture and weak will, are likely to go hand in hand. Development of good posture requires consideration of the mental, physical and morphological aspects.

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[4]*Katharine F. Wells and Kathryn Luttgens, Kinesiology Scientific Basis of Human Motion (Philadelphia : W.B. Saunders College, 6th ed. 1976, pp. 393, 400.*

## Type of Posture

Posture means position and a multi-segmented organism and as such the human body, cannot be said to have a single posture. Posture is an index of health. Where posture improvement seems desirable, consider first the factor, which makes a person feel like standing, walking or sitting the way he habitually does.

Posture can be "inactive or active". Inactive postures are adopted for resting, sleeping or training general relaxation. In inactive postures, the essential muscular activity required to maintain life is reduced to a minimum. Active postures required an integrated action of may muscles to maintain these. Active postures may be either "static or dynamic". A static posture is maintained by the interaction of group of muscles which work more or less statically to stabilize the joints, and in opposition to gravity or other forces whereas, a dynamic posture is required to form a efficient basis for movement, and the pattern of posture is constantly modified and adjusted to meet the changing circumstances which arise as a result of movement.[5]

An efficient posture requires strong muscles, nervous control for neuro-muscular coordination, a stable psychological background, good hygienic conditions and an opportunity for plenty of natural free movement.

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[5] *Dena Gardiner, "The Principles of Exercise Therapy", 4th ed. (Delhi: C.B.S. Publishers, 1985), p. 245.*

An intact nervous system coordinate various postural reflexes muscles, eyes, ears and joint structures which are essential for assuming and maintaining and efficient good posture.

## GOOD POSTURE AND POOR POSTURE

### Good Posture

Good posture is characterized by best mechanical efficiency, the least interference with organic function and the greatest freedom from strain. Good posture is even related to economics. Since good posture has aesthetic appeal, it is considered as a desirable social asset and one makes better impression and can there by, impress more people in business and professional life.[6]

It is only in good posture that the body functions best. Ease and grace of body movements are promoted by correct posture which in turn contributes to health by promoting good body-mechanics. An efficient posture in standing and sitting is to be esteemed as much for its social and psychological value as for its direct hygienic value.

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[6] *J.L. Rathbone and V.V. Hunt, "Corrective Physical Education", 7th ed. (Philadelphia: W.B. Saunders Company, 1965), pp. 83-84.*

Good habits also help to perform good posture like the way we speak, sit, walk, sleep, stand, lie etc. the way we carry things on arms, or back, hang on the shoulders or on head, are all constitutes of good posture which we generally envy. However, posture varies with age, occupation, type of activity, physique and health.[7]

The way a person carries himself makes an important impression. From his appearance, people draw certain conclusions about his health, his vitality and his personality. Experience teaches us to expect enthusiasm for living, initiative, self confidence and self respect from a person with an easily erect posture.

Erect posture enhances the feeling or well being. There is the ability to consciously stand well with the same joy, which comes with any skill. To know that you know how to stand well, that you can and are standing well, gives a feeling of self-confidence and poise.[8]

Good posture helps the body to work best and easy. It promotes easy and graceful movements, which help the body to function properly. Good posture might be defined as that position in which the centre of gravity of each body segment is centered over its supporting base. It mainly depends on the maintenance of centre of gravity in proper way, body erect, alert whole, with proper balance and poise.

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[7]*Ellen Davis Kelly, Teaching Posture and Body Mechanics (New York : The Ronald Press Company, 1949), p.5.*

[8]*N. Parmeshwara Rao, Kinesiology Physical Ediucation and Sports (West Godawari : S.S.R. Government College of Physical Education), p.96.*

By good posture is meant and adjustment of body parts to each other which results in a erect, alert whole, representing readiness for mental and physical effort. Body is like machine if its parts are maintained in good balance it functions smoothly. The performance of any machine is determined by the proper alignment of its parts. Good posture, in repose and in activity permits mechanically efficient function of the joints.

Friction in the joints is minimized, tension of opposing ligaments is balanced and pressures within joints are equalized. Hence the skeletal structure is architecturally and mechanically sounds and there is minimum of wear and tear on the joints.[9]

This is no less true for the kinesiologically oriented physical educator. To him, posture is a gauge of mechanical efficiency of kinesthetic sense, of muscle balance and of neuro muscular coordination. Good posture, both static and dynamic, requires normal muscle tones. This implies adequate development of the antigravity muscle to resist the pull of gravity successfully and to maintain good alignment without excessive efforts or tension. It also implies a balance between antagonistic muscle groups. There is no indication, however, that the stronger the muscles the better the posture. Good posture requires good coordination. This implies good neuro-muscular control and well developed postural reflexes.

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[9]*Wells and Luttgens, Kinesiology Scientific Basis of Human Motion, p.404.*

The importance of posture in its relationship to emotional and intellectual behaviour needs to be recognized at the initial stages. In this man is concerned with his output and better use for efficacious attainment of capabilities. Good posture promotes an attractive appearance with its accompanying psychological benefits, both for the individual and the favourable impression made upon others. This is worthwhile and should offer prime motivation to adolescents as an objective. It is recognized that good posture undoubtedly adds to one's aesthetic appearance, enhances the impression made on others and in social adjustment.

An individual's habitual posture reflects the general health and state of mind. Happy person tends to be erect and smart whereas sick or depressed person tends to be of slump or lanky posture. Personality also leaves and effect on posture. Introvert or shy natured man will have shabby and lanky structure whereas embivert personality has smart, erect and attractive posture. The literature is replete with the concepts and the observations of relationship between emotional behaviour of individuals and the posture assumed by them.

Rathbone and Hunt have observed that an individual's habitual posture reflects the general health and state of mind. A buoyant and happy person tends to be erect and extended while an ill or depressed individual tends to be slump. Posture is considered by many to be an indication of the spiritual as well as the emotional tone of the individual.[10]

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[10] *Encyclopaedia of Sports Sciences and Measurement, S.V. "The Posture," by Helen B. Pryor, p.1161.*

The keen body mechanics observers may detect telltale sign of deep-seated disability or incapacity for dynamic healthful living through a postural appraisal. Unbalanced segments are liable to produce strain and irritation of important nerves, and can be gauged as the mental concomitants of poor posture.

The study of posture involves the position of the various body segments at any given movement. It considers the mechanics of movement, especially the more fundamental movements of walking, running and sitting, as well as those related to daily tasks such as bending, stooping, pushing and lifting. There is even and optimum sleeping posture. Individual body build and its influence on behaviour, together with anthropometrics measurements in general, are related to posture.

The maintenance of posture and the corrective movements that restore balance involve the activities of a large portion of the skeletal musculature and many parts of the central nervous system. Every movement starts from posture and ends in a posture, but during the execution of the movement the postural contractions are altered or abolished.[11]

Mental attitudes seemingly can induce pleasing or displeasing postures. Professional people who have worked with the mentally ill have reported that there are characteristic postures with certain types of illness. Posture has been used as a potential index of clinical value. Neurotic people tend to sway more than the normal individual because of muscle tensions.

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[11] *Laurence E. More House and Augustus T. Miller Jr., Physiology of Exercise (St. Louis : The C.V. Mosby Company, 1976), p. 42.*

These tensions seemingly tend to interfere with the awareness of the individual of minor degree of sway that is normal.[12]

Superior intelligence and tremendous energy are some time housed in a body that is habitually slouched. Some great athletes assume a habitual posture of extreme relaxation.

Good posture cannot be forced upon a child. Any factor either of health or environment, which weaken muscular strength or encourage exaggerations of spinal curve, will produce poor posture. Children with habitual poor posture had more disease, fatigue, under-weight, self-consciousness, fidgeting, hearing defects, restlessness, timidity, and asthma. Functional postural defects are commitant symptoms of illness and poor health. The malnourished child for example, who does not have the caloric intake to supply needed energy, simply does not have the strength to hold himself up; poor posture is the inevitable result. A depressed mental attitude, chronic fatigue, or an intestinal parasite might produce the same result.[13]

It is commonly accepted that a person's alertness and general outlook on life may be indicated by the likeness of the person's posture to the ideal posture. With each attitude, whether consciously or unconsciously recognized, there is an

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[12] *Encyclopaedia of Sports Sciences and Measurement, pp.1081-82.*

[13] *Carl E. Willgoose, Evaluation in Health Education and Physical Education, (New York : McGrow Hill Book Campany, Inc., 1961), p.188.*

apparent accompaniment of motor response. At certain ages, feelings of shyness bashfulness, self-consciousness, insecurity, and inferiority may play an important part in respect to posture.

The attitudes of adults towards posture have been considered as doing much toward creating satisfactory attitudes in children. Children have been observed to imitate the mannerism of adults in sitting a standing and walking.

## Poor Posture

Poor posture is also detrimental to the appearance of the young man. Most people with poor posture will become progressively worse as they grow older. Poor posture reduces physical fitness of a person because of the resulting pressure and thereby there is displacement of visceral and other internal organs, blood vessels and nerves, whose displacement results in impairing their organic functioning and activities. The person with poor posture is ungainly, awkward and unesthetic.

III posture is the result of exaggerating the cervical curve in the neck and lumber curve in the back III posture produces quick fatigue.

Good posture obeys certain laws of physics in that efficiency involves the smallest possible expenditure of energy to maintain it; when standing erect the centre of gravity is low in the abdomen and movement of the body requires less energy than when the posture is faulty. When one part of the body is off

centre it pulls another off centre to balance it, both of which require energy and produce fatigue.

Poor posture causes a cramped position of heart, lungs and abdominal organs. Circulation of the blood is impeded and the organs farthest from the heart fail to receive adequate oxygen. Under stretching of muscles in bad posture causes nerves and muscle fatigue. Bad posture is responsible for undue strain on joints and ligaments, which, after a time results in pain. Just as lack of alignment in an automobile causes friction so poor posture causes fatigue fear and tear in humans.[14]

Children need more exercise to counter-act sedentary habits. Good health and strength all reflected in bearing chronic fatigue, malnutrition, illness and psychological feelings, which motivate an attempt at self-effacement, affect posture. Other causes may be poor adjustment of seats and desks, poor lighting, poor vision, impaired hearings, careless habits of sitting, walking and standing, and poorly fitted shoes and clothes. Postural fads, which develop in high school, such as throwing the trunk back on the pelvis, produce poor posture.

A postural alternation of vertebral alignment during the growth period could become permanent in time. Tall students tend to throw the head too far forward and develop "round shoulder." Congenital anomalies or diseases of the vertebrae, involvement of their cartilaginous surfaces as in rheumatoid arthritis,

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[14] *Encyclopaedia of Sports Sciences and Measurement, pp.1161-62.*

spasm of supporting muscles to the spine caused by a slipped disc, or weakness of the supporting muscles themselves all have produced poor posture.

It has been observed that there is no single best posture for all individuals. Each person must take the body he had and make the best of it since, it is an individual matter.[15]

The body, like machine, is most efficient when all its parts are maintained in good balance. Wealth, beauty, and brains may not be distributed to everyone but except for the cripple good posture is accessible to all who will work for it. The importance of carriage and poise at all ages can not be over emphasized.

Mental alertness and physical efficiency certainly go together. Good posture is necessary for proper function of all the organs. Good body mechanics can be defined as the mechanical coorelation of skeletal, muscular, neurological, and organ system is most favourable for function. If organs are displaced or crowded by bad posture, serious disorders may develop in human body organs, which are adapted to upright posture.[16]

There is some indication that the assumption of good posture is partly the result of understanding what good posture is and partly because of the desire to have good posture. Ideal posture is that in which the various segments of the

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[15] *John M. Cooper and Ruth B. Glassow, Kinesiology, 3rd ed. (St. Louis : The C.V. Mosby Company, 1972), p.186.*

[16] *Encyclopaedia of Sports Sciences and Measurement, pp.1162.*

body head, neck, chest and abdomen are all balanced vertically, one of the other, so the weight is borne mainly by the bony frame work, with a minimum of efforts and strain on the muscles and ligaments.[17]

The posture reflexes that follow to maintain an erect position against the force of gravity depend on muscle tone, stretch reflexes, Kinesthetic sense, and balance. They are all susceptible to training. Poor habits may lead to a variety of physical complaints or disorders. Good posture is characteristic of a good state of physical fitness and poor posture ordinarily goes with relatively poor fitness. Therefore, weak musculature and poor posture are the result of such underlying causes as malnutrition, fatigue, disease, under activity and personal attitude of depression, withdrawal and insecurity.

One of the basic elements in posture is the stretch reflex. It is important in the maintenance of posture and balance and is best developed in extensor muscles, which are ordinarily involved in maintaining a posture against the force of gravity. Another group of postural reactions that is of paramount importance in sports is equilibrium or balance. In complex motor skill activities it is essential that the body be in the correct posture for the performance of necessary movements.

Human kind's biologic heritage has left them vulnerable in the area of posture and body mechanics. As prehumans scaled higher and higher on the

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[17] *Willgoose, Evaluation in Health Education and Physical Education, p.189.*

evolutionary ladder and ultimately assumed the biped position, several adverse effects resulted in the skeletal and muscular system as they under went the necessary anatomical adaptations. Added stress was placed on the digestive and circulatory systems as well as the skeletal. Some major adjustments were made in the evolutionary process to off set these negative effects. However, in complete evolutionary adaptations to the biped position has left humans with problems which have been accentuated by their mode on the part of the aging people is to do daily exercise and the physical activity necessary to acquire and maintain good posture. It is only in the correct posture that the bodyfunctions best. Ease and grace of body movements are promoted by correct posture, which in turn contributes to health by promoting good body mechanics.

A bad or poor posture is a faulty relationship of various parts of the body which produces increased strain on supporting structures and in which there is less efficient balance of body over its base of support.

A bad or poor posture may be caused by:

1. Injury, e.g. fracture, dislocation, an untreated sprain etc.,
2. diseases, like osteomalacia, rickets, tuberculosis of bone etc.,
3. habit, which may be formed due to an injury, disease or habitual standing on one leg.
4. muscular or nervous weakness, may be caused by under nutrition or fatigue,
5. mental attitude, e.g. depression, inferiority complex etc.,
6. heredity, or
7. improper clothing, e.g. too tight or too loose clothes or shoes etc.

Poor or bad posture has got its physical, physiological, social and psychological ill effects. "Bad posture with its poor body mechanics is accompanied by lack of muscle-tone, lowered threshold to fatigue, and lessened available mechanical energy. Especially, in older people exaggeration of normal curves tends to become set-in-rigid patterns and interfere with normal physiology".[18]

Poor posture causes a cramped position of heart, lungs and abdominal organs. Circulation of the blood is impeded and the organs farthest from the heart fail to receive adequate oxygen.[19]

Under stretching of muscles in bad posture causes nervous and muscular fatigue. Bad posture is responsible for undue strain on joints and ligaments, which after a time results in pain. Just as lack of alignment in an automobile causes friction, similarly, poor posture causes fatigue, wear and tear in humans.

Children with habitual poor posture had more disease, fatigue, underweight, self-consciousness, fidgeting, hearing defects, restless, timidity and asthma. Functional postural defects are commitant symptoms of illness and poor health.[20]

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[18] *E.L. Bortz, "Stress and Exhaustion", Journal of American Medical Association 164(1957): 2059.*

[19] *S.S. Kety, "Human Cerebral Blood Flow and Oxygen Consumption as Related to Aging", Journal of Chronic Diseases 3 (1956): 478*

[20] *Carl E. Willgoose, Evaluation in Health Education and Physical Education (New York: Mc Graw Hill Book Company, Inc., 1961), p. 188.*

The maintenance of an erect posture is a distinct problem to the humans since the skeleton is fundamentally unstable in this position. The two-legged human body presents a continuous problem in maintaining balance because the feet are a very small base of support for a multi segmented towering super structure.[21]

Bad posture with its poor body mechanics is accompanied by lack of muscle tone, lowered threshold to fatigue. Older people should try to correct the factors contributing to poor posture, which includes poor eyesight or hearing, which makes a person lean forward or cock his head in an unnatural position to see or hear better. Over fatigue, malnutrition, anxiety, or lack of interest in life, lack of symmetry in muscular development because lack of exercises; sitting in strained; restraint of body movements by clothes or shoes that do not fit; and sleeping in strained position caused by sagging mattresses or bed springs or using pillows large enough to bend the neck forward. One can over come the inherent weakness in body mechanics only by developing those muscles that are used in maintaining good body posture in sitting, standing, walking, running and exercising.

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[21] *E.D. Kelly, Teaching Posture and Body Mechanics (New York: The Ronal Press Company, 1949), p. 9.*

Posture and body mechanics are related to physique and body types. The more modern approach to posture emphasizes that there is no single best posture but there are many best postures. Posture becomes an individual matter, chiefly because of individual body types. Each person should develop a good body posture within the frame work of his/her body build. Good posture is characterized by best mechanical efficiency, the least interference with organic function and the greatest freedom from strain. When these criteria are applied to the frame work of specific body type, good posture will be characterized by good balance and proper alignment of the various body segments. No two people will be identical and the pattern of posture will always vary slightly in accordance with physique and body type from person to person. Thus, posture development comes within the province of the physical educator. The part played by muscles in maintaining good body position, cannot be over emphasized. Good posture not only had a relationship with health, but it has also psychological implications. It is even related to economics. Since good posture has aesthetic appeal one makes better impression and can therby impress more people in business and professional life.

Postural evaluation is very important. Body alignment depends not only upon the integrity of the joints themselves but also upon the muscles acting upon the joints.[22]

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[22]*Allen J. Ryan and Fred L. Allmen Jr., Sports Medicine, (New York : San Fransisco Academic Press, 1974), p.93.*

Bad body mechanics and poor posture are the result of exaggerating the cervical curve in the neck and the lumbar curve in the back. These exaggerations throw the skeleton out of good alignment and consequently the organs are not properly supported. In many areas of the world where people carry burdens on their heads, they develop perfect posture.

Postural defects often go undetected and therefore contribute to fatigue and muscle imbalance that often results in injury. Correct posture is therefore important as it enhances the function of the organic system. It reduces the strain on muscles, ligaments and tendons and there by retards the onset of muscle fatigue. It also increases the attractiveness of the person.[23]

The spine plays a central role. All mammals except man have a single dorsal curve in their spines. The human spine contains four curves from front to back, cervical, dorsal, lumbar and sacral which enables the head to balance more easily in the upright position. The new born human follows the pattern of the single dorsal curve at the birth and does not develop the other curves characteristic of man until later. When he lifts up his head he develops the cervical curve in his neck and when he starts walking in upright posture, he develops the lumbar curve in the small of his back. The requirements of good standing posture are (1) stand as tall as possible with head help up so that the top of the head will be flat enough to hold a book, (2) chest high with rib cage

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[23] *Encyclopaedia of Sports Sciences and Measurement, pp.1161-62.*

expanded, (3) the lower abdomen held in and the gluteal muscles tense and (4) the extremities well poised to support the body weight with minimum exertion.[24]

Bad posture with its poor mechanics, accompanied by lack of muscle tone is a lowered threshold to fatigue and lessens the available mechanical energy. Especially in order people exaggeration of normal curve tends to become set in right patterns and to interfere with the normal physiology.

Spinal deviation includes Kyphosis-hunch backed curvature, Lordosis-exaggerated forward curvature in the lower part of the back, and Scoliosis-lateral curvature and forward till of the head.

The spinal column is not a straight rod. The vertebrae are aligned one above the other to form a straight line when viewed from the back, but when viewed from the side there are mild natural curves in the neck (cervical), chest (thoracic), lowback (lumber), and pelvic (sacral) regions. Exaggeration of these curves produce what is commonly termed "Poor Posture." An angulations forward of the vertebrae, usually in the upper thoracic region, is referred to as Kyphosis (hunch back, hump back). This occurs at times because of organic or structural changes and more commonly from posture. An increased inward curve, ordinarily in the low back, is labeled lordosis (sway back). The spinal column may also present a deviation laterally (side to side curve); producing scoliosis.

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[24] *Ibid*

The period of most rapid growth of vertebrae is from 11 to 15 years of age. The are shaped as ossification continues to completion. This shaping and response to weight bearing is naturally affected by posture. The key to good posture is the lumbosacral joint in the low back. It carried the weight of the trunk, head and upper extremities, and permits flexibility of the upper part of the body on the pelvis.

The performance of any machine is determined by the proper alignments of its parts. Consequently all directors of athletics and physical training should recognize that the earlier proper steps are taken to correct or ameliorate postural faults, the greater will be the proficiency in performance and coaching of an athlete to his maximum. Lack of proper attention to correctable faults in his body mechanics, may accelerate the aging process and promote disturbance in his musculoskeletal apparatus that will result in an earlier development of "wear and tear" arthritis.

The compensatory changes in trunk caused by tilts in the pelvis usually result in scoliosis, with rotator shifts in the spinal column. The long round back has a short lumbar lordotic curve, and the round hollow back has the dorsal kyphosis and a longer lumbar lordisis. In most persons with such deviations there usually exist a widening of the inter scapular space and corresponding adaptive shortening of the pectorals and serrate. All the movements of the arms in throwing (javelin throw, shot put, discus and swimming) there is a limitation of shoulder extension.

Pronated feet with valgus ankles and some increase of out ward tibial torsion result in stress on the anterior and posterior tibial muscles with shotening of their antagonists, the peronei, that can very seriously limit the success of runners and jumpers and are prone to weakened knee conditions.[25]

Good posture is that state of muscular and skeletal balance which support and protect the structure of the body against injury or progressive deformity irrespective of the attitude adopted as running, kicking, swimming, squatting etc. in which the body structure is working or resting as in sleep. Under such conditions the muscles will function most efficiently and to the optimum position and provide full protection for thorax and abdominal organs.

Poor posture is a faulty relationship of the various parts of the body, which produce increase strain on supporting structure and in which there is less efficient balance of body over its base of support.

The common postural defects are:

1. Round shoulder, with protruding shoulder – blades, depressed chest and protruding – abdomen.
2. Scoliosis, or lateral curvature of spine column.
3. Forward – tilting head.
4. Lordosis, or forward curvature of the spinal column in the lumbar region or lower back
5. Flat back (not common in school children).

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[25] *Encyclopaedia of Sports Sciences and Measurement, p. 240.*

6. Improper balance.
7. Pronated ankles.
8. Flat feet.
9. Fatigue slouch.
10. Knock-knees.
11. Pigeon-toes walk.

One common cause of poor posture is malnutrition. The child's muscles are weak. He needs better food, more rest, and greater muscular strength. Fatigue may under lie his poor posture. Because of poor hygiene or recent illness the pupil does not have sufficient strength to carry the days programme without becoming over tired. This fatigue shows itself in his slumped position. The obese child is likely to develop poor posture because of excessive weight, which the body framework has to carry. The child with some visual and hearing defect may carry his head forward or tip it to one side. Improperly adjusted clothes or high heels and wrong habits in using play materials or carrying burdens are some-times responsible for the poor mechanical use of the body. Some postural faults are due to poor habits of sitting or standing and walking.[26]

Attention must be paid to environment. The classrooms must be correctly lighted so that children do not have to stoop forward in an attempt to see well, or to twist the body in order to avoid glare. Proper adjustment of

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[26]*C.E. Turner, Harriott B. Raudall and Sara Louise Smith, School Health and Health Education (St. Louis : The C.V. Mosby Company, 1970), pp. 72-73.*

seating equipment for each young person, regardless of age level, should encourage him to a good sitting position. Child should be taught how to sit properly. He needs changes of activities so that he will not sit for too long period. He should use play ground equipment to make his activities and exercise pleasurable. He should be more posture-conscious, without being nagged. Teaching methods should motivate youngsters at each age level, to adopt good postural practices. Good practices of sitting, standing and walking develop good posture in the growing child.[27]

A teacher should alert the children to health problems and environmental situations which cause fatigue and slumping. On way to promote good posture is to arouse interest and pride in maintaining a good posture by arranging annual posture contests.

Parents also need to be educated to provide healthy environment at home to enable a child to sit and study properly.

There are several values of good posture:

(a) Hygenic: The erect straight body has its organs properly set so that bodily functions are more complete, perfect and harmonious.

(b) Economic Value: May be a contributing factor for competition good posture can add to the work efficiency, whereas improper posture leads to decrease in work efficiency, thus affecting the economic aspects.

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[27] *Alma Nemir and Warren E. Schaller, The School Health Programme (Philadelphia : W.B. Saunders Company, 1975), pp. 74-76.*

(c) Social Value: Fine body has good and balanced shape and therefore highly attractive.

(d) Spiritual Values: An individual with well-balanced posture brings appreciations for the creator i.e. "God." The glory of the rising sun which has its own charm, can hardly be appreciated by a person (who walking with protruded head, abdomen and flat feet) with bad posture. Good health, good looks and social value develop their own forms and performances, which are their charm and beauty and are less likely to develop any of the deformities.

There are three categories of posture:

(1) Endomorph – Long, thin, cylindrical with developed muscles of short stature.

(2) Mesomorph – The are most stable neither tall nor short, psychologically and mentally sound and stable, and move freely in the society.

(3) Ectomorph – Very tall, lean and thin, less weight etc.

Awkward posture is greatly handicapped. Psychologically inferior and of shy nature. There are several causes for the bad posture, some of them can be corrected or controlled and for some complete correction is not possible.[28]

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[28] *P.K. Pande and L.C. Gupta, Out Line of Sports Medicine (Ludhiana : Jaypee Brother, 1987), pp. 201-202.*

Specific exercise programmes are recommended for correction of postural defects. The purpose of this exercise is to improve the strength, coordination, and elasticity in the body. Developing actively the flexor muscles of the lumbosacral spine and stretching passively the extensor muscles and fasciae accomplish this. Faulty posture must be corrected and proper posture must be maintained at all times.

The significance of posture in its relationship to emotional and intellectual behaviour as well as the laterality of cervical variances on visual perception need to be recognized before, during and after physical activity. Those who are concerned with results at the least cost of energy output would do well to investigate such applications to innate mental capacity and human movements for better use of such forces for the efficacious attainment of capabilities.[29]

Exercise for the development and maintenance of range of motion plays and important role in rehabilitation of the handicapped and is an essential part in treatment of acute and chromic trauma in orthopedic work. Specific exercise such as those used for postural correction is the concern of Orthopedists, Pediatricians, Physical Educators, and Physical Therapists. Various types of exercises are used to restore and recondition the patient. They are used to

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[29] *Encyclopaedia of Sports Sciences and Measurement*, p. 240.

prepare athletes for the performance of physical skills. The effects of exercise apply equally to therapeutic exercise as they do to exercise and sports generally.[30]

The Physical Education Teacher, The Coach and the Trainer should be aware of acceptable structural differences and deviations among human bodies. It is also important that the students learn to detect deformities and abnormalities in body alignment that reflect poor posture and have a thorough understanding of those differences crucial to anyone involved in the prescription of exercises.

It has been observed that habits play an important role to develop the posture. Life has become so fast that individual does not have time to take care of himself as well as of his family. If parents pay some attention on their children and note their habits engagements, they might be able to bring some improvement in their children. Schools also play an important part in developing the child's personally and attitude.

The teacher must pay special attention on the sitting, standing habits of the student because a teacher has a strong bearing on the children's behaviour. The teacher should have pleasant personality with sense of humor, ready smile, sympathetic attitude and good health, so that the children feel the sense of belongingness, love and affection. It may be noted that children implicitly emulate and try to copy the teacher's personality. If the teaching programme is

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[30] *James G. Hay and J. Gavin Reid, The Anatomical and Mechanical Bases and Human Motion, (Englewood Cliffs, N.J.: Prentice Hall Inc,. 1982), p. 30.*

planned wisely and taught intelligently, it will contribute to sound health, pleasant habits, strong and healthy attitude for the children to develop a strong personality.

Some factors which may play have with a child's personality should be carefully removed by the parents and the teachers. The children should be taught the methods of doing the things correctly. The child should be taught how to walk, talk, run or lift weight. Wrong methods of doing things may adversely affect the body such as a child carrying a heavy bag on one shoulder may be completed to walk limpingly or lean on one side and with the passage of time the child may develop bad posture which would defective gait and also affect his vision. If the weight of the bag is divided on both shoulders, it can help to reduce the bad curvature of the back and the child would be able to walk comfortably and gracefully. Stylish way of living has also its impression on an individual. People have become conscious about their diets and how they dress. They want to be in tune with modernity. They are not aware of the side effects of their doings. They think that by wearing loose of tight clothes make them look 'advance' in the society. They are not aware that too loose or tight fittings can produce odd movements, which could cause bad posture. Cushioned beddings also have the tendency to affect the spine growth adversely. Sleeping on hard surface helps the spine to keep straight which is very essential for good posture. Stylish shoes or foot wear may spoil the gait of a child. They should not be allowed to put on fancy, high healed or tight shoes because they are bound to leave bad effect on the posture. Such foot wear can cause headaches or false gait

and produce shabby posture. The child should also be taught of placing or lifting of weight because spine helps an individual move freely. If the movements are not done correctly they will affect the balanced growth of the body and develop certain postural defects.

School should have adequate time for studies and games. There should be adequate study rooms with proper lighting and ventilation with proper seating arrangements so that the children are not subjected to any undue fatigue. Teaching load should not be very heavy to create any sort of boredom to the children. They should have adequate play grounds with ample playing facilities and enough time for exercising. Proper care must be taken to avoid any kind of postural deformities. School should manage to have twice a year, body and health check-up of the students because the spine of a child being in growth is quite flexible and with certain physical activities and exercises might bring drastic changes in his body and personality.

## Statement of the Problem

The purpose of the study as to detect the common postural defects namely flat-foot, scoliosis, kyphosis and lordosis among Secondary School Boys in relation to minimal strength and also to develop a corrective programme to eliminate identified postural deformities.

The problem is stated as under:

"Survey of postural deformities of Lucknow School Children in relation to minimal strength."

## Delimitations

1. The study was delimited to the Government Secondary School Boys of Lucknow.
2. The present study was further confined to only the following postural defects:
    (i) Flat Foot.
    (ii) Scoliosis.
    (iii) Kyphosis.
    (iv) Lordosis.

## Limitations

1. The present study was confined to detection of postural defects in relation to minimal strength but the congenital causes responsible for these deformities were not taken into consideration.
2. Non-availability of sophisticated instruments for identifying postural defects was treated as a limitation for this study.

## Hypothesis

1. It was hypothesised that common postural defects prevalent among boys would be kyphosis, lordosis and flat foot.

2. It was further hypothesised that lack of strength may be main causative factor leading to postural deformities among Government Secondary School Boys.

## Definition and Explanation of the Terms

### Posture

Posture is described as on in which the head is held erect, the chest is forward, the shoulders are drawn back and the abdomen is retracted.[31]

Posture involves the alignment of parts of the body to achieve balance in sitting, standing, walking or physical activity. The bony skeleton and muscle govern the balance, which varies with age, occupation, and type of activity, physique and health.[32]

Posture is that in which the body segments are balanced in the position of least strain and maximum support.[33]

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[31] *Philip Rash and Rogerk Burk, Kinesiology and Applied Anatomy, 2nd ed. (Philadelphia : Lea and Febiger, 1963), p. 384.*

[32] *Alma Nemir and Warren E. Schaller, The School Health Programme, (Philadelphia : W.B. Saunder Company, 1975), p. 71.*

[33] *John M. Cooper and Ruth B. Glassow, Kinesiology, 3rd ed. (St. Louis : The C.V. Mosby Company, 1972), p.186.*

## Flat Foot

Foot is called that foot when collapse of internal longitudinal and transverse arches of the foot combine with eversion. If the medial longitudinal arch of the foot touches the ground on weight bearing or is nearer the ground, then the foot is considered to be flat.[34]

## Scoliosis

Scoliosis has been defined as curvature of the spine in a lateral or coronal plane or it is lateral displacement of the spine in the cornal.[35]

It is lateral curvature of spine. The shoulder on one side will be lower than the other. The hip of the opposite side will be higher, the arms hang loosely at the sides, the angle between arm and body is greater on one side than on the other.[36]

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[34]*Nigel H. Harris, Post-graduate Test Book of Clinical Orthopedics, (Bristol : Johnwright and Sons Ltd., Stone Bridge Press, 1983), pp.49-50.*

[35]*Ibid., p. 147.*

[36]*Arthur S. Daniels and A. Devies, Adopted Physical Education, (New York : Harper & Row Publisher,1975), p. 168.*

## Kyphosis

Kyphosis is an exaggeration or increase in amount of normal convexity of the thoracic region of the spine.[37]

## Lordosis

Lordosis is an exaggeration of normal lumber curve accompanied by forward till of the pelvis.[38]

## Minimal Strength

Is a score obtained as a result of administration of Kraus-Weber Test.

## Kraus-Weber Test

Is a test, which indicates the level of strength and flexibility for certain key muscle groups below, which the functioning of the whole body as a healthy organism seems to be endangered.[39]

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[37] *M. Gladys Scott, Analysis of Human Motion – A Text Book in Kinesiology, (New York : Applenton Century Crofts Inc.,1942), pp. 333-334.*

[38] *Rash and Burk, Kinesiology and Applied Anatomy, p.385.*

[39] *H. Harrison Clarke and David H. Clarke, Application of Measurement to Physical Education, (Englewood Cliffs, N.J. : Prentice Hall Inc.,1987), p. 131.*

## Corrective Programme

Corrective programme is that which has the power to correct or remove the faults.

## Significance of the Study

A good posture is an asset in achieving high performance in games and sports. It has been observed that those suffering from postural deformities are unable to put up good performance, which they otherwise could make depending upon their abilities and capacities. Postural deformities also hinder in the optimal application of various motor components in competitive situation. Therefore, teachers of physical education should be vigilant and identify postural defects and take necessary steps to remove them so as to enable each child to excel in the field of games and sports.

The present study would be of significance in the following ways:

1. The study would help to identify common postural defects prevalent among school children.
2. The study would indicate the relationship of different postural deformities in relation to minimal strength, if any.
3. The study would provide guide lines by way of a suggested corrective programme to eliminate postural defects of school children.

Chapter II

# REVIEW OF RELATED LITERATURE

Although numerous researches have been conducted regarding the health, physical fitness and postural problems of the school going children, yet no proper and scientific research has been focused on the very postural problem of the school boys in relation of their family back ground. Therefore, the scholar has selected a new scientific and burning problem related to the postural defects of the young boys and examined their relationship with the family background of the individuals. However, out of the extensive search, which the scholar has made to locate the related literature, the relevant reviews found are cited in this chapter.

A serious attempt was made by the research scholar to go through the literature related to the present study. A brief review of these studies is enumerated in this chapter.

Kelly[1] has pointed out posture as an index of health. For good health general health habits should be checked and all possible steps should be taken to correct faulty influences. Only then posture training and posture exercises should be given to achieve the best result.

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[1] *Ellen D. Kelly, Teaching Posture and Body Mechanics (New York : The Ronald Press Company, 1949) : p. 5.*

Davies[2] has found that postural divergences may inhibit or prevent a child from participating successfully in motor activities. It has often been said that balanced posture enables one to have graceful and efficient movement. If a person's body in out of alignment or is asymmetrical, he is not expected to have efficient movement pattern. It may be the result of psychological, physical, or psychosomatic difficulties.

Deaver[3] has pointed out the relation of posture to mental and physical health. He has said that posture is an index of personality. For good health correct posture should be taught early as one of the essentials of health. Erect posture is an expression of intelligence and character and index of physical efficiency. Correct posture of body is first importance as ill health results in incorrect posture.

Cooper and Glassow[4] associated erect posture with attitude of readiness, self confidence and assurance which certainly gives better appearance, better advantage and expression of attentiveness.

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[2]*Evelyn A. Davies, "Relationship Between Selected Postural Divergences and Motor Abilities," Research Quarterly 28 (March 1957) : p. 1.*

[3]*G.G. Deaver, "Posture and its Relation to Mental and Physical Health," Research Quarterly (March 1933) : p. 221.*

[4]*John M. Cooper and Ruth B. Glasssow, Kinesiology 3rd ed. (st. Louis : The C.V. Mosby Company, 1972) : p.185.*

Wells and Luttgens[5] have found posture as a position, and multisegmented organism of human body. They said that emotional reactions of an overly sensitive individual turn to abnormal posture. For good posture, good coordination requires to avoid tension in muscle group.

Nemir and Schaller[6] have found the bony skeleton and muscles govern balance, which varies with age, occupation, type of activity, physique and health.

Rathbone and Hunt[7] have found that an individual's habitual posture reflects the general health and state of mind. A happy person tends to be erect and extended while an ill or depressed person tends to slump and lanky. Posture is considered by many to be an indication of the spiritual as well as the emotional tone of the individual.

Moriarty and Irwin[8] have found that the relationship of physical and emotional factors have effect on posture. There should be proper training of

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[5]*Katharine F. Wells and Kathryn Luttgens, Kinesiology Scientific Basis of Human Motion 6th ed. (Philadelphia : W.B. Saunders Company, 1976) : p. 393.*

[6]*Alma Nemir and Warren E. Schaller, The School Health Programme 4th ed. (Philadelphia : W.B. Saunders Company, 1975) : p. 71.*

[7]*J.L. Rathbone and V.V. Hunt, Corrective Physical Education 7th ed. (Philadelphia : W.B. Saunders Company, 1965) : p. 9.*

[8]*Mary J. Moriarty and Leslie W. Irwin, "A Study of the Relationship of Certain Physical and Emotional Factors to Habitual Poor Posture Among School Children, Research Quarterly 23 (May 1952) : p. 221.*

body so that best possible state of health might be obtained. Self-consciousness, fatigue and other psychological states are reflected in postural pattern. Physical defects and environmental factors leave bad effect on posture, which result in fatigue, infection, discouragement and physical defects.

Bortz[9] had defined that bad posture with its poor mechanics is accompanied by lack of muscles tone, lowered threshold to fatigue and lessened available mechanical energy.

Kety[10] found poor posture causes a cramped position of the heart, lungs and abdominal organs. Circulation of the blood is impeded and the organs farthest from heart fail to receive adequate oxygen. Undue stretching of some muscle is bad posture and causes muscles and nerve fatigue.

Brown[11] has found through his investigation, which was designed to determine the relationship between body type and body alignment and centre of balance. Each subject was classified into body type components of endomorphy, mesomorphy and ectomorphy. Methods used for measurement was Sheldon's technique for somatotyping a modified technique of Hawland's ailgnometer for body alignment and the Lovett – Reynolds techniques for determining the centre

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[9]*E.L. Bortz, ary J. Moriarty and Leslie W. Irwin, *A Study of the Relationship of Certain Physical and Emotional Factors to Habitual Poor Posture Among School Children, Research Quarterly 23 (May 1952) : p. 221.*

[10]*S.S. Kety, "Human Cerebral Blood Flow and Oxygen Consumption as Related to Aging." Journal of Cronic Diseases 3 (1956) : pp. 478-486.*

[11]*Gaydena M. Brown, "Relationship Between Body Types and Static Posture of Young Adult Women." Research Quarterly 31 (October 1960) : p. 403.*

of balance. Statistically, somatotype was not significantly related with body alignment of with the centre of balance. However, significant correlations were found to exist between height and trunk length measures and between a ratio of trunk measures and body alignment.

Pande and Gupta[12] have pointed out that inferiority complex habit decreases efficiency. Ectomorph usually develops kyphosis, poor musculature and shyness. Endomorph includes many deformities such as flat-foot, knock-knees and bow legs. Besides these also there are many other causes i.e. poor posture, injury nervous weakness, heredity, improper clothing and accidents.

Kelly[13] has pointed out that persons having pain and strain in the feet could develop, pronated feet and its correction is gigantic task among the school children. He also noticed that low positive significant correlations were found between flexibility of the arch and criteria of pronation and low negative and low negative correlation between flexibility of the arch and degree of out toeing. He reported that functional foot complaint is relatively un-common among children and very common among adults. Fifty to sixty percent of the child population has shown promotion to greater or lesser degree.

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[12]*Pande and Gupta, Out Line of Sports Medicine, p. 202.*

[13]*Ellen Davis Kelly, "A Comparative Study of Structure and Function of Normal, Pronated and Painful Feet Among Children," Research Quarterly 23 (December 1947) : p. 291.*

Mekenzic, Clement and Taunton[14] have pointed out that the runners with excessively pronated feet have features which predispose him/her to injuries that most frequently occur at the medical aspect of the lower extremity: tibial stress syndrome; patellofemoral pain syndrome; and posterior tibialis tendinits. These problems occur because of excessive motion at the subtalar joint and control of this movement can be made through selection of appropriate foot wear, plus orthotic foot control. As runner with out curved feet often has a rigid foot and concomitant problems of decreased ability to absorb the force of ground contact. The shoes should be board-lasted, straight lasted, have stable heel counter, extra medial support and wider flare than the shoes for the curve foot.

Kumar, Saronwala, Thapar and Mathur[15] have proved that the higher the arch the better is the leverage, action of foot and efficiency of functional activity especially in running. High arch indicates better feet which are stronger, more elastic and more efficient in all natural uses of foot; therefore, high arched foot should be preferred for the best runners, whereas low arched feet indicate conditions which are associated with pain, early fatigue or inefficiency in all natural uses of foot.

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[14]*D.C. Mekenzie, D.B. Clement and J.E. Taunton, "Running Shoes, Orthotics and Injuries," Sports Medicine An International Journal of Applied Medicine and Science in Sports and Exercise 2 (September/October 1985) : p. 334.*

[15]*Som Kumar, K.C. Saronwala, S.P. Thapar and D.N. Mathur, "Study of Arches of Foot in Runners," Sports Medicine 4 (Summer 1975) : p. 5.*

Morehouse and Miller[16] have pointed out that standing increases fatigue by cerebral anemia and reduction in cardiac out-put. Local fatigue of the feet, which frequently interferes with production in job that require prolonged standing, change in posture from the upright to varying degrees of the recumbent position and periodic elevation of the feet serve as practical measures to reduce cardio-vascular strain and fatigue, especially in hot environment.

Rathbone[17] has pointed out numerous factors for causing weak feet. Faulty carrying positions for infants, or faulty skeletal alignments of legs and feet during the first weight bearing on knees or feet during the creeping and toddling stages or faulty shoeing when little feet are so mallcable. These mechanical features will cause poor foot statics.

Jones[18] headed the study on flat-foot had found that "Flat Feet may actually be protective whereas high arches may be a risk factor for injury." Generations of flat-footed candidates have been rejected by the military under the assumption that they were more prone to injury. But new data indicate that flat feet may actually prevent lower-limb injuries. Researchers at the US Army Institute of Environmental Medicine, the Walter Reed Army Institute of

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[16]*Laurence E. Morehouse and Augustus T. Miller, Physiology of Exercise (St. Louis : C.V. Mosby Company, 1976) : p. 159.*

[17]*Josephine Longworthy Rathbone, Corrective Physical Education (London : W.B. Saunders Company, 1955) : p. 14.*

[18]*Bruce Jones, "Flat-foot Nonsence," Reader's Digest 137 (October 1990) : p. 142.*

Research and The Nike Sports Research Laboratory collaborated on a study. In it, the feet of 248 infantry trainees were photographed before 13 weeks of basic training. The subjects, grouped according to arch height, were then followed and monitored for training associated injuries. The findings: the higher the arch, the greater the risk of injury. Trainees with high arches were 2.4 times more likely to suffer a foot injury than were flat-footed trainees.

Hughes, Clark and Klenerman[19] have conducted studies on the toes movements. The importance of well-functioning toes has long been recognized but has not previously been assessed in biomechanical studies. They have examined the weight bearing function of the foot in 160 normal subjects by use of the pedograph. The function of the toes was assessed by reference to the time they were in contact with the ground and the peak pressures they exerted individually in comparison with other parts of the foot. The toes were in contact for about three quarters of the stance phase of gait and exerted peak pressures similar to those of the metatarsal region. When the foot was bearing the second peak of total force, the area in contact with the ground (the metatarsal heads and toes) was decreasing.

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[19] *J. Hughes, P. Clark and L. Klenerman, "The Importance of the Toes in Walking," Current Awareness from Excerpta Media Section 33, 35:5 (1990) : p. 232.*

Rodell[20] has found out that pelvic tilt had significant but slight relation with hip flexibility and essentially zeros relation with the other measures. Abdominal muscle strength was substantially correlated with abdominal muscle endurance, but ankle probation and hip flexibility were essentially uncorrelated. The leg span, leg length measurement of hip flexibility was a reliable and easily administered test. The evidence indicated that the pelvic tilt of a person with normal musculature and flexibility was due largely to postural training and habit.

Sortland, Tysvear and Stroli[21] have noticed that mostly football players develop slight or moderate scoliosis due to degenerative changes in the cervical spine. Few players "headers" reported to have suffered from cervical complaints pain and stiffness for years and some to the players develop spondylosis.

Watson[22] pointed out that lumbar lardosis was significantly higher in individuals who specialized in soccer. Scoliosis and abduced scapulae were more common in the hurdlers. The flat feet as high in the foot ballers and hurdlers. Abduceted scapulae ere uncommon in rugby players. In a group of

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[20]*Rodell Thayer Jorris, "The Relationship Between Abdominal Muscle Shortening and Anterior Posterior Pelvic Tilt," Competed Research in health, Physical Education and Recreation 3, (1961) : p. 30.*

[21]*O. Sortland, A.T. Tysvear and O.V. Stroli, "Changes in the Cervical Spine in Association Football Players," British Journal of Sports Medicine 16 (June 1982) : p. 80.*

[22]*A.W.S. Watson, "Posture and Participation in Sports, "The Journal of Sports Medicine and Physical Fitness 23 (September 1983) : p. 238.*

Footballers and soccer players who were studied longitudinally, the degree of lumbar Lordosis increased during the course of two playing seasons. Groin strain and back injury were found to be more common in sports men with Lordosis. It is suggested that athletic activity may sometimes lead to postural defects, which are probably a predisposing factor in certain types of sports injury.

Munchow and Alber[23] have found that in adolescent children in the age group 14-19 years ossification of spine had not completely ended. Thus the training excited scoliosis and formation of transitional vertebrae, which was more in the case of athletes than the weight lifters. He has therefore observed that it would be important to exclude such adolescents at the beginning of the training whose ossification of spine had not completely set-in.

Barry and Cureton[24] have observed three type factors of physique, one related to growth in transverse directions and adipose tissue, and two related to growth in vertical dimensions, and three related to motor performance, were isolated: power endurance, dynamic shoulder strength. The morphological and performance measurement were found to be essentially unrelated. As one related

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[23]*H. Munchow and H. Alber, "The Spine in Weight Lifters."* Sports Medicine *2 (July 1973) : p. 57.*

[24]*Alan J. Barry and Thomas K. Cureton, "Factorial Analysis of Physique and Performance in Repubcent Boys,"* Research Quarterly *32 (October 1961) : p. 283.*

to growth in-transverse directions and adipose tissue characterized by bulkiness, prominent girths (upper arms) broad hips, narrower shoulders and thick fat covering.

One related to growth in vertical dimensions and characterised by a lean frame and attenuated limb.

One related to dysphasic growth in vertical dimensions and characterized by disproportionate development of trunk and legs.

Three factors related to motor ability were isolated:

(i) Power dominated by jumping events and distinguishing those with high, from those with low ability to handle the body weight.

(ii) Endurance, distinguishing individuals with high from those with low organic efficiency.

(iii) Dynamic shoulder strength, which separate those with high muscular endurance in activities requiring strength of the shoulders from those with low muscular endurance. This factor was more closely related to the morphological variables than was the case with the other two motor fitness factors and may be related to muscular growth.

(iv) The second order factors were extracted: general size, differentiating between those who are above and those below average in total body mass

Sward et al[25] have made studies on the changes in thoraco-lumbar spine of athletes. Back pain and radiological changes of the thoraco -lumbar spine were investigated in 142 top athletes, representing wrestling, gymnastics, soccer and tennis (age range 14-25 years). All groups of athletes reported back pain at high frequencies (50-85 per cent). Male gymnasts had significantly increased incidence and severity of back pain as compared to the rest of the athletes. Radiological abnormalities occurred in 36-55 per cent of the athletes. Reduced disc height, schmorl's nodes and change of configuration of vertebral bodies correlated with back pain ($P<.05$, $P<.01$ and $P<.05$). Significant co-variation between these types of abnormalities was found. Athletes with great demands on the back are thus subjected to an increased risk of symptomatic damage of the spine.

The spine of athletes, at least in some vigorous sports in subjected to frequent and considerable loads with subsequent risks of back injuries and back pain. An increased frequency of radiological abnormalities of the spine has been found among young athletes in certain sports, such as wrestling (55 per cent), gymnastics (42 per cent) and water ski-jumping (45 per cent).

In the general population, most radiological abnormalities are considered non relevant or of questionable significance in individuals with back pain. Reports on the correlation between back pain and radiological thoraco-lumbar abnormalities in athletes are sparse and contradictory.

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[25]*Leif Sward et al., "Back Pain and Radiologic Changes in the Thoraco-Lumbar Spine of Athletes," Spine 15:2 (1990) : p. 124.*

The aim of the present study was to investigate the occurrence of back pain among athletes in various sports and to analyse its correlation to radiological changes in the thoracic-lumbar spine.

Ohtsuka, Yamagata and Arai[26] have stated the screening program for scoliosis started by Chiba University in 1979 consists of using more topography, low dose roentgenography and a final ordinary X-rays examination. The number of children screened through this Chiba University Medical School (CUMS) screening program to 1986 amounted to 1, 246, 798. The incidence scoliosis of more than 15 per cent increased linearly according to age from the fifth grade primary school children (0.07 per cent) in boys, (0.44 per cent) in girls to the second grade Junior High School students (0.25 per cent) in boys, (1.77 per cent) in girls. The female predominance of scoliosis cases with curvatures of more than 30 per cent detected during the total period was 10:1 and this female predominance was the same for primary school children and junior high school students. According to a study of the incidence of scoliosis by districts (area was divided according to population density and urbanization) there were no significant differences in the fifth grade primary school children between the sparsely and densely populated areas. In the cases of children beyond the fifth grade primary school level, however, the incidence in the densely populated areas were significantly higher than those in the sparsely populated districts. The

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[26]*Y. Ohtsuka, M. Yamagata and S. Arai, "School Screening for Scoliosis by Chiba University Medical Screening Programme," Current Awareness from Excerpta Media Section –33 34:2 (1989) : p. 75.*

incidence of scoliosis of more than 20 per cent decreased significantly every year among Junior High School students, because, they were screened periodically in school and the scoliosis students who had already been detected were left out of the next screening. This study established that screening for scoliosis by the CUMS Screening Program is cost-effective with a load risk of radiation hazards.

Belgesundeu and Rottker[27] have found out that Radiograms were taken of subjects with no symptoms of cervical spine problems; the cervical spine was evaluated in the spontaneous posture and at maximal flexion and extension. The position and movement of the vertebra inter-vertebral height and gliding were calculated. The results showed that (1) Lordosis in women occurred less pronounced than in men, and that there was an increased with age; (2) C 2-3 was the least flexible segment and motility increased in the caudal direction; mobility decreased with age and the segment of the lower cervical spine with the highest mobility decreased the most; (3) all posterior and ventral intervertebral heights showed a decreased with age at C 5-6 and C 6-7; (4) Vertebral gliding decreased with age.

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[27]*Wch L. Belgesundeu and H. Rottker, "Analysis of Cervical Spine Function in Health Persons (Germ)," Current Awareness from Excerpta Media Section – 33 35:6 (1990) : p. 263.*

Goldberg and Dowling[28] have found out that the handedness of 254 girls with idiopathic scoliosis minimum age eight years at diagnosis, attending our lady's hospital was related to their scoliosis convexity. Curve patterns were assigned to right or left on the basis of the convexity of the low thoracic component only, regardless of primary curve. The curve pattern matched handedness in 82 per cent of 228 right-handed children, 197 had a right convex curve pattern; of 26 left-handed children 12 had a left convex pattern. The correlation between scoliosis configuration and handedness was statistically significant. This is in contrast to the findings of previous studies, which have considered convexity only, without reference to the configuration of the whole spine. The implication is that of these findings is that scoliosis is associated with cortical functions.

The correlation between handedness and direction of curve convexity shows adolescent idiopathic scoliosis to resemble lateralized human functions. The evidence is not enough to indicate that laterality alone could be considered anetiologic factor, since the ratio of the right to left-handedness in the whole group does not differ from the expected in the general population. The relevance for etiology is in the possibility of perceiving scoliosis in a different light.

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[28]*C. Goldberg, and F.E. Dowling, "Handedless and Scoliosis Convexity : A Reappraisal," Spine 15:2 (1990) : pp. 61-63.*

Winter[29] has noticed that recognition of the idiopathic double primary thoracic curve pattern has become increasingly important, as more defective methods of internal correction of curves have been developed. Over correction of the lower thoracic curved beyond the spontaneous correctability of the upper thoracic curve may lead to an undesirable asymmetric neck and shoulder contour.

Herbert and Boke Chako[30] more than ten years ago, they began the nighttime treatment of early scoliosis in growing children with implanted muscle stimulators. The early devices were radio frequency (RF) compiled units with an implanted receiver and external transmitter antenna, which the patient used at night to power and activate the implant. Compliance with this treatment was 95 per cent. Recent developments have led to the use of a new, totally implantable stimulator for the treatment of scoliosis curves. The unit has no external components, is programmed and interrogated by telemetry and is externally, switched by the patient using a magnet. Compliance with it continues at a high level, product reliability to date has been perfect and the clinical results continue to be good.

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[29] *R.B. Winter, "The Idiopathic Double Thoracic Curve Pattern, Its Recognition and Surgical Management," Current Awareness from Excerpta Media Section – 33 35:4 (1990) : p. 151.*

[30] *M.A. Herbert and W.P. Boke Chako, "Scoliosis Treatment in Children Using A programmable, Totally Implantable Muscle Stimulator (ESI)," Current Awareness from Excerpta Media Section –33 34:8 (1989) : p. 369.*

Flint and Diehl[31] have investigated the relationship between antero-posterior alignment of the trunk and strength of the muscle, which flex and extend the trunk. The result showed significant relationship between trunk strength and alignment.

A low but definite relationship exists between back-extensor strength and alignment.

Devis[32] has made the study on the status of postural patterns. The study is an analysis of 750 physical examination record cards from 5 selected years. Postural pattern changed over the years. Significant difference between the percent of the occurrence was found for many factors. The most wide spread postural deviations still include forward head, forward shoulders, protruding abdomen, pelvic tilt, and promoted feet.

Nearly all types of scoliosis decreased significantly over the years studied. This study proved that with advancing age if other posture defects menifest significantly scoliosis appears to be reduced.

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[31] *M. Marilyn Flint and Bobbie Diehl, "Influence of Abdominal Strength, Back-extensor Strength, and Trunk Strength balance Upon Anterio-posterior Alignment of Elementary School Girls," Research Quarterly 32 (December 1961) : p. 490.*

[32] *Patricia Davis, "An Investigation of the Status of Postural Patterns of Smith College Women," Completed Research in Heaalth, Physical Education and Recreation 10 (1968) : p. 96.*

Nissemen et al.[33] have examined a total of 1060 children (515 girls, 545 boys) for screening of trunk asymmetry and scoliosis at an average age of 10.8 years. The physical examination consisted of height, sitting height, total arm length and leg length in equality determinations and more topography. Forward bending test measured trunk asymmetry and poster anterior standing radiograph of the spine was taken of those 188 (17.7 percent). Children who had a trunk hump ≥ 6 m. only 20.1 percent of the children were found to be exactly symmetric in the forward bending test, 47.3 percent had a right sided hump and 32.6 percent had a left sided hump. Humps of 6 mm or more were significantly (P = 0.03) more prevalent among girls (12.7 percent) than boys (16.3 percent). Moire fringe asymmetry was proved to be common: only 9 percent of the material was totally symmetric, two thirds had asymmetry of ≤ 1 fringe, 26.6 percent had a symmetry > 1 and ≤ 2 and 5.4 percent > 2. The prevalence of scoliosis (trunk hump ≥ 6 mm and C 066 angle ≥ 10 percent) was 4.1 percent. The majority (72.1 percent) of the curves were left convex.

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[33] *M. Nissemen et al., "Trunk Asymmetry and Scoliosis, Anthropometric Measurement in Prepuberal School Children,"* Current Awareness from Excerpta Media *Section–33, 35:3 (1990) : p. 131.*

Singer, Jones and Breidahl[34] have surveyed the sagittal plane curve characteristics of the thoracolumbar spine which were evaluated from 286 lateral chest radiographs comparing the cobb technique with a computer-aided digitizer. Thoracic kyphosis and curve apex were measured from T-3 to T-11 segments, and in 120 cases, the level of thoracolumbar curve inflexion point was determined. An age related increase in curve magnitude was similar for both measurements, although computer generated kyphosis angles were generally larger. The apex of thoracic kyphosis was consistently located near T-7 for males compared with greater variability with age for females. The thoracolumbar inflexion point shifted caudally with increasing years, being most marked for females. The ability to describe quantitatively the thoracolumbar curve characteristics, calculate angles between selected segments, determine points of inflexion and maximum curvature, indicates that radio-graphic evaluation of sagittal spinal curvature is improved with the use of computer-aided measurement.

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[34]*K.P. Singer, T.J. Jones and P.D. Breidahl, "A Comparision of Radiographic and Computer – assisted measurment of Thoracic and Thoracolumbar Sagittal Curvature," Skeletal Radiology Journals of the International Skeletal Society 19:1 (1990) : p. 21.*

Flint[35] has investigated the relationship of gravity line test to posture. He had found that relationship exists between the gravity line test and the massey segmental alignment posture rating test was not significant. A high negative correlation exists between hip trunk flexibility and posture of lumbar and pelvis regions. No significant relationship exists between the position of the gravity line and (a) abdominal or back extensor muscle strength or (b) hip-trunk flexibility.

Minotti[36] has made study of S.S. for 3rd and 4th grade students with postural deviations. S.S. was randomly assigned to either an experiment (E) or control (C) group. The S.S. in the E group were assigned individual exercises for correction and the E group did the exercises in addition to regularly attending physical education classes for 3 months. During this time of period the C group attended only physical education classes, when both the groups tested for postural deviations. Ancora showed that the total posture and anterior-posterior component of the E group were significantly better than that of the C group. But there was no difference between the 2 groups in the lateral.

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[35]*M. Marilyn Flint, "Relationship of Gravity Line Test to Posture, Trunk Strength, and Hip Trunk Flexibility of Elementary School Girls," Research Quarterly 35 (May 1964) : p. 141.*

[36]*Lisa A. Minotti, "Effect of an Exercise Program on Posture Improvement," Completed Research in Heaalth, Physical Education and Recreation 21 (1970) : pp. 205-206.*

Eberting[37] has given selected exercises for the improvement of lordotic postural deviations and he has found that the experimental group performed a graduated battery of 4 exercises involving the abdominal and lower back for 12 class periods and achieved significant improvement of lordotic postural deviations in this experiment group. Whereas the control group who participated in unrelated activities during the same period could not gain any benefit. It is obvious if related programmed or exercises are selected according to the requirements of the individual can give positive result.

Alderman[38] has made study on posture by taking photographs of 83 girls revealed that 93 percent had posture deviations. Subject had little or no previous posture instruction and after 8 lessons in regular health education classes, 62 percent of the subject showed improvement. It is not necessary that posture correction can be done with exercises only. If we can correct their bad habits and teach them correct movement of the posture, can achieve improvement in general.

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[37]*Samdra L. Eberting, "The Effect of Battery of Specifically Selected Exercises in the Improvement of Lordotic Postural Deviations," Completed Research in Heaalth, Physical Education and Recreation 10 (1968) : p. 22.*

[38]*Melba Kay Alderman, "An Investigation of the Need for Posture Education Among High School Girls and a Suggested Plan of Instruction to Meet These Needs," Completed Research in Heaalth, Physical Education and Recreation 10 (1968) : p. 117.*

Scott's[39] had investigated that there was no significant difference in the muscle action potential of selected postural exercises which purport to strengthen the trapeziers muscle as measured by quantative electromyography. He rejected this hypothesis, as Duncan's Multiple Range Test demonstrated that there was a significant difference among many of the exercises and at each age level and for the combined groups. There is no significant difference among S.S. of various age levels in the muscle action potential of the selected postural exercises as measured by quantities electromyography. This hypothesis was accepted, as kendall's co-efficient of concordance was significant among the different age groups which ranked the 12 selected exercises. Formation of muscles can be influenced by the exercises irrespective of the age.

Barham[40] has pointed out in his study that "The posture group" has made significant improvement because of devoted 20 percent of each class period to posture training activities throughout the school year. Whereas non-posture group did not show any kind of improvement because of the fact they were not imparted any posture training activities.

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[39]*Charlotted Scott, "A Quantative Electromyographic Study of the Trapezius During Selected Exercises Designed to Ameliorate the Postural Deviation Designated as Round Shoulder," Completed Research in Heaalth, Physical Education and Recreation 12 (1970) : p. 243.*

[40]*Johen W. Barham, "Posture Programs for Elementary School Children," Completed Research in Heaalth, Physical Education and Recreation 6 (1964) : pp. 60-61.*

Fullilove[41] conducted a study to evaluate the nature causes and effect of selected problems related to posture research in an effort to interpret the posture literature in a proper perspective and to grasp a better understanding of future approaches to research. The inadequacies of the tools utilized in research were discussed in relation to the definitions of the products, standards for evaluation, and methods and techniques of measurement.

Munson[42] has found critical changes occurred in the chest, abdominal and hip regions between grades 1 and 3 which were important to well balanced anterior posterior posture. The frequency of anterior – posterior postural deviations indicated a crucial need for re-emphasis on posture education.

Kuhns[43] found that 50 percent of children surveyed had some weakness or the other foot disorder and that about 80 percent of all adult persons examined, suffered from some sort of foot disorder. He also stressed on the necessity to teach good carriage of the body and good use of the feet.

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[41] *Ann Margaret Fullilove, "A Critical Analysis of the Problems Encountered in Posture Research," Completed Research in Heaalth, Physical Education and Recreation 12 (1970) : p. 158.*

[42] *Corlee B. Munson, "An Evaluation of Posture Screening Techniques for Children," Completed Research in Heaalth, Physical Education and Recreation 9 (1967) : pp. 64-65.*

[43] *John Kuhns, "Physical Therapy in Disabilities of the Foot," Physiotherapy Review 21:3 (May-June 1941), p.147.*

Chapter III

# PROCEDURE

The selection of subject, procedure adopted for identifying postural defects, administration of Kraus-Weber Test, application of corrective exercises programme and the statistical model adopted for analyzing data are described in this chapter.

## Subjects

1006 boys studying in classes 8 and 9 in four schools controlled by the Lucknow Administration were selected as subjects for the investigation. Before administering test the purpose of the investigation was explained to the Principals, Physical Education Teachers and the subjects of these schools. With the help and understanding of the teachers and the students of various schools the research scholar gained optimal cooperation for this study.

## Selection of Postural Defects

The research scholar had discussions with experts in the field of corrective physical education and sports medicine and also went through the available literature. Based on discussions and study of literature the following

four postural defects commonly prevalent among children were selected for the study:

1. Flat-foot
2. Scoliosis
3. Kyphosis
4. Lordosis

## Spondylometer

The proper measuring of the spinal deformity is a most important factor in the initial assessment. Curves are named according to the region of the spine in which the apex of the curve is located. The cervical curve is a curve of the apex between C1 and C6, a dorsal curve of the apex between T2 and T12 and a lumber curve is one with an apex between L1 and L4[1].

The most significant deviations from a normal spinal posture result from the loss of the secondary spinal curves; with the elimination of first the lumbar and later, the cervical Lordosis. The thoracic curves are exaggerated and the spine becomes progressively rounded. As lateral deviations are comparatively rare, the appropriate method of recording spinal posture is the spondylometer. **See Fig. 1.**

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[1]*Nigel H. Harris, Ed. Post Graduate Text Book of Clinical Orthopaedies (Bristol : John Wright and Sons Ltd., 1983) : pp. 49-50.*

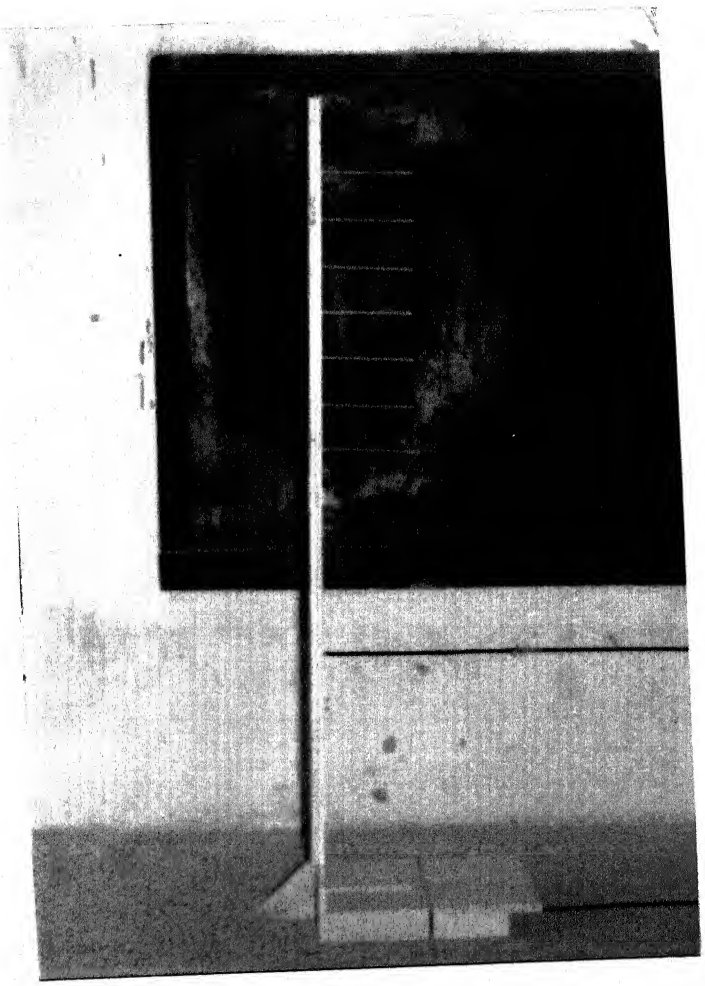


**Fig.1 SPONDYLOMETER USED FOR MEASURING SPINAL CURVES.**

The spondylometer has a base of platform long vertical rod and horizontal and adjustable pegs. The subject stands on the base of the spondylometer in an upright "most erect posture," he can assume. The heels touch intervals in the upright are adjusted to make light skin contact over the vertebral spines and locked in position. Measurements of the subjects overall height, cervical, thoracic, and lumbar regions are taken. The distance of projection of the pegs from the upright is measured and these readings are noted to determine the angles of the curves of the spine in order to find out any deviations in the posture. The spondylometer, therefore, is a useful and reliable instrument for measuring the angles of the spine.[2]

## Instrument Reliability

In as much as the spondylometer – the instrument used for identification of postural defects could not be procured from Institute for Physically Handicapped, Hospital and Medical Research Centre. Due to its non-availability, the research scholar had a meeting with Mr. R.M. Maurya, Superintendent, Physiotherapy, and after having gone through the available literature the decision was taken to get the spondylometer fabricated in a workshop.

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[2]*Patricia A. Downie, Ed. Text Book of Orthopaedics and Rheumatology for Physiotheraphists (London: Faber and Faber Limited, 1985) : p. 356.*

For this purpose services of a trained carpenter were utilized who prepared the spondylometer as per the specifications provided to him. After getting the instrument fabricated, the same was shown to expert and only after seeking his approval the instrument was used for collection of data. All parts of the spondylometer i.e. the vertical bar, the horizontal adjustable pegs, the plat-form and the holes on the vertical bar were measured in the presence of the expert so as to ensure the reliability of the instrument for collection of data. The measurements of different parts of the spondylometer were as follows:

Plat-form – 60 cms. x 40 cms.

Length of Vertical bar – 2.0 m.

Length of the peg – 20 cms.

Distance between the holes – 10 cms.

After having seen the instrument the expert certified that the instrument would ensure collection of reliable data.

## Test Reliability

The research scholar took a number of measurements sessions under the guidance of expert to ensure accuracy of measurements. Finally, to ensure tester's reliability in taking measurements, the research scholar in the presence of the expert tested five subjects. The expert was fully satisfied with the manner in which postural defects were identified and measurements recorded.

## Procedure of Administration of Test

The research scholar carried spondylometer and pedograph alongwith her to the various schools where she conducted surveys to collect the required data. After briefing the subjects regarding good and posture, deformities and their effect on health, personality and efficiency, the work started with the weighing machine. Thereafter height was taken with the help measuring tape which was fixed on the left side of the spondylometer. Curves for cervical, thoracic and lumber regions were measured with the help of marked pegs fixed in the centre of the spondylometer. After completing the measurements in various schools, the subjects were divided into different height groups in the range of 5 cms. difference. The normal posture was taken out for all height groups, with normal curvature in the cervical, thoracic and lumbar regions. On that basis the subjects were divided into normal and abnormal groups of posture and the subjects with abnormal posture were taken up for study. The subjects were Kraus Weber Test to measure the muscle strength of each student. They were given different corrective exercises for twelve weeks pertaining to particular deformity. Then again the subjects were given the Kraus-weber Test and their posture was re-checked on Spondylometer and measurements noted. The same method as adopted for flat-footed subjects on pedograph with a view to evaluate effectiveness of the conditioning programme on the posture.

## Flat-Foot

**Equipment :**

Pedograph.

**Procedure :**

The foot print was taken as the criterion for the detection of flat foot. Before taking the foot print, the subject was given the detailed instruction regarding the use of pedograph. Foot prints were taken on the pedograph which was made of an ordinary steel box fitted with thick pad sheets. Finger prints ink was evenly spread on the pad sheets with a brush. The subject was asked to stand bare-footed on the pedograph and made to press his feet for proper inking and thereafter to stand on the paper sheets placed before him on a hard card-board and asked to press his feet carefully in order to have the proper foot impression on the paper. Through this method height of the longitudinal arch was obtained for detection of flat-foot. In this manner the foot prints of all the students, under study, were obtained. **See Fig. 2, 3, 4 & 5.**

**Fig.2 SUBJECT IN READY POSITION FOR MEASURING FLAT-FOOT**

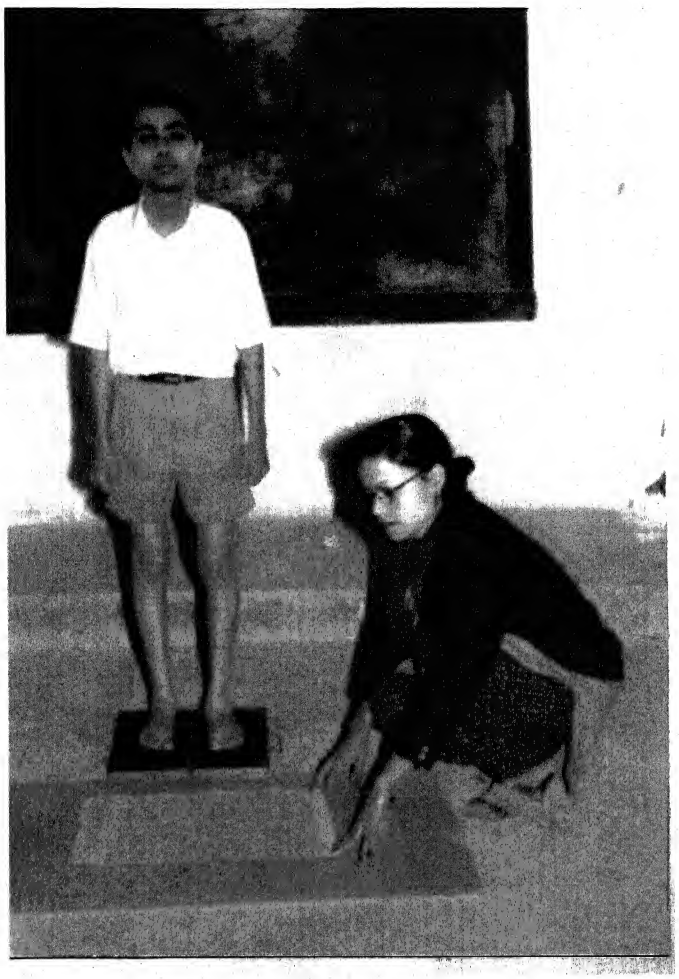

**Fig.3 SUBJECT ON THE PEDOGRAPH FOR INKING THE FEET**

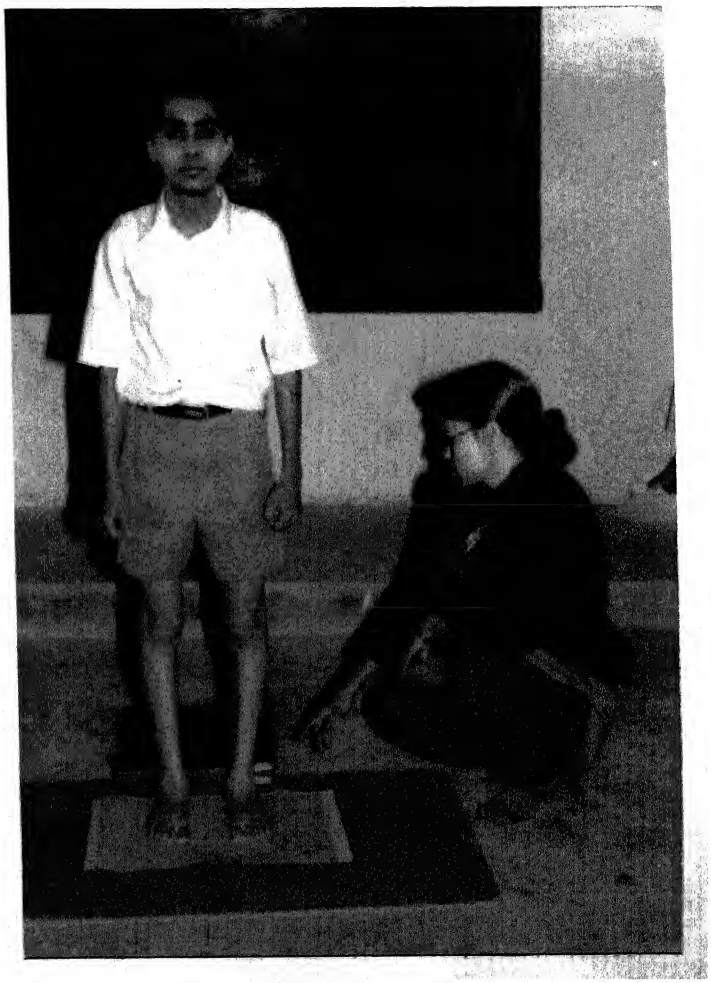

**Fig.4 SUBJECT STANDING ON THE GRAPH PAPER FOR MARKING OF THE FOOT PRINT**

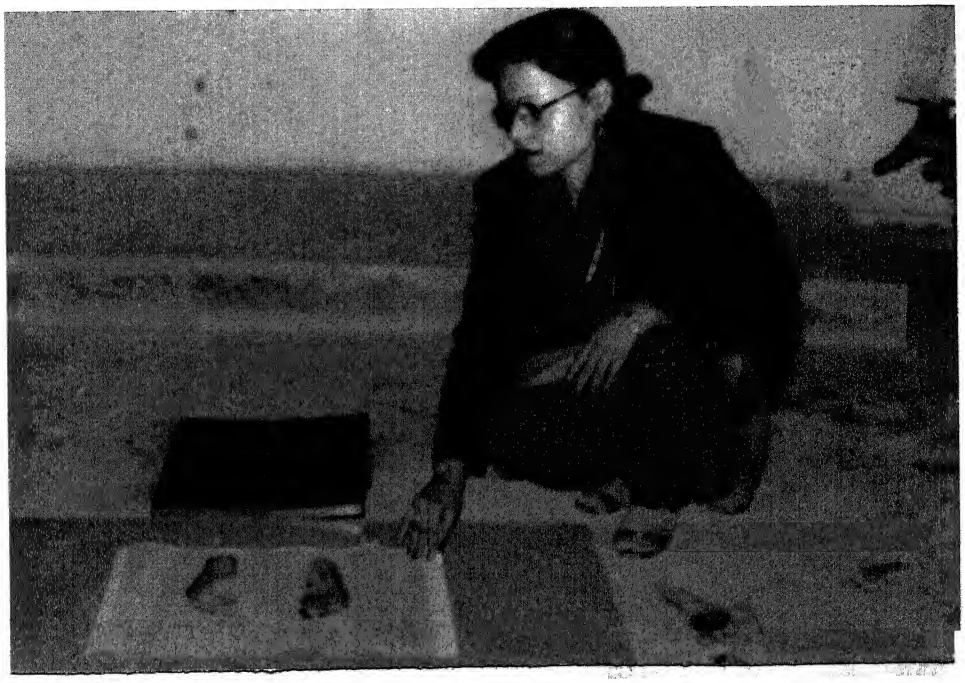

**Fig.5 FEET IMPRESSION ON THE GRAPH PAPER**

## Scoliosis

**Equipment:**

Spondylometer

**Procedure:**

The curve was taken as a criterion for cervical region for detection of scoliosis. Before starting the test subject was given detailed instructions about the use of spondylometer. Seventh cervical was marked with ink so that it should not touch the peg. The marked pegs were fixed in the holes, which were made at distance of 4 inches. The subject wore only shorts for the measurement of their spinal curve. The subject was asked to stand bare footed by keeping his heels on the marked base with feet apart, hands down in relaxed position, neck straight and touching the peg fitted on the spondylometer. The subject was asked to take his head back and stand erect as if against a wall. The subject was made to stand atleast for 5 minutes in order to notice his habitual standing. The curve in the middle of cervical region noted down for scoliosis.

**Scoring:**

Norms were worked out for different heights with the gap of 5 cms. i.e. 1-5, 6-10 and so on. Scoring was done in each case in the light of norms worked out for various height groups minimum 131-135 cms. and max. 175-180 cms. **See Fig. 6.**

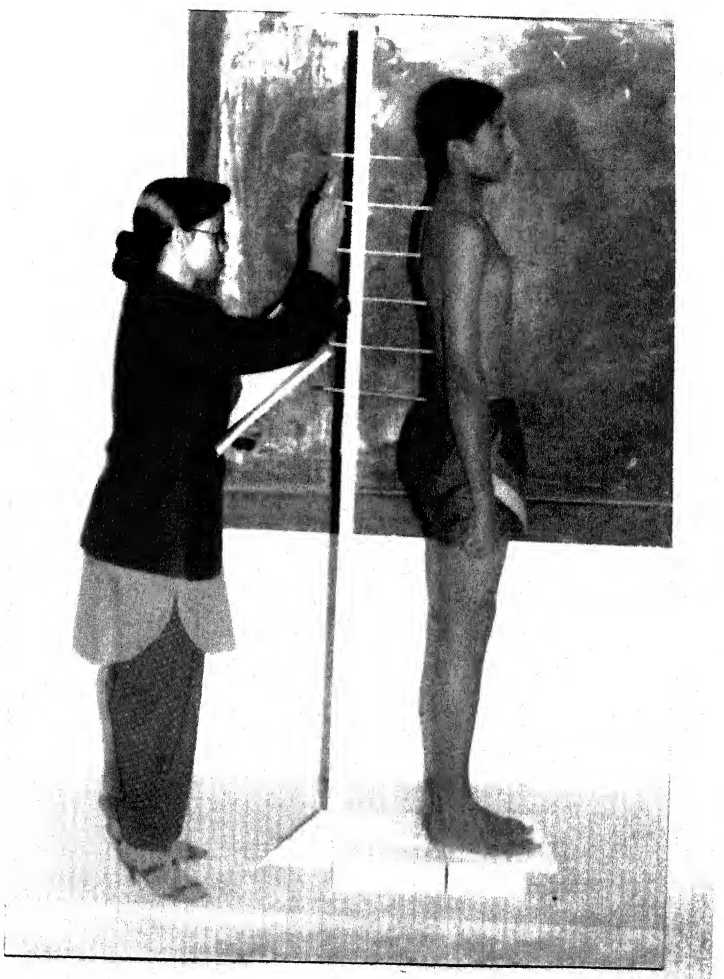

**Fig.6 MEASUREMENT OF SPINAL CURVE-SCOLIOSIS.**

## Kyphosis

**Equipment:**

Spondylometer

**Procedure:**

The curve was taken as a criterion for thoracic region for kyphosis. After briefing each for the use of spondylometer, marked pegs were fixed in the holes made at distance of 4 inches on the spondylometer. The subject was made to stand with only shorts on and bare footed on the spondylometer, on the marked base with feet apart, the back touching the pegs and hands down in relaxing position and keeping the neck straight. The subject was thereafter asked to stand with his body in erect position as if standing against a wall. The curves in the upper throracic, middle thoracic and lower thoracic measured on marked pegs were noted for kyphosis.

**Scoring:**

Scoring was done on norms worked out for different height groups with the gap of 5 cms. minimum 131-135 cms. and maximum 175-180 cms. **See Fig. 7.**

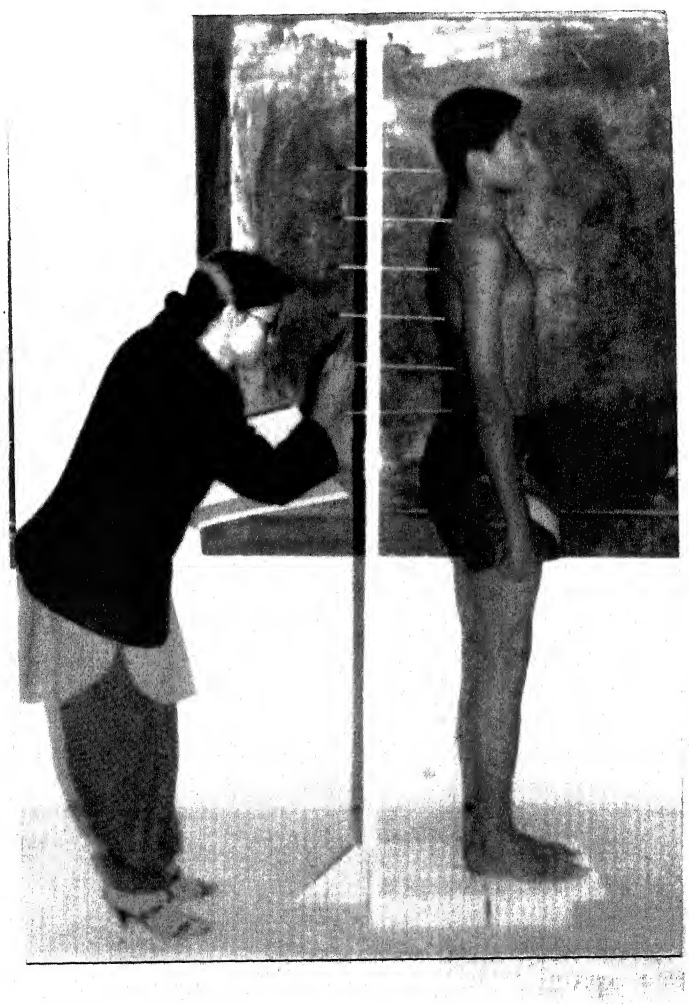

**Fig.7 MEASUREMENT OF SPINAL CURVE-KYPHOSIS**

## Lordosis

**Equipment:**

Spondylometer

**Procedure:**

Curve of lumbar region was taken as a criterion for detection of lordosis. The subject was given detailed instructions about the use of spondylometer. Marked pegs were fixed on spondylometer at a distance of 4 inches. The subject appeared with only shorts on and bare footed. The subject was asked to stand on the marked base of spondylometer with feet apart and hands down in relaxing position, neck straight, chest erect with back touching the pegs. Thereafter the subject was asked to stand as if standing against the wall. The curve in the middle of lumbar region was noted down for lordosis.

**Scoring:**

Norms were worked out for different height groups with the gap of 5 cms. minimum height group 131-135 cms. and maximum 175-180 cms. **See Fig. 8.**

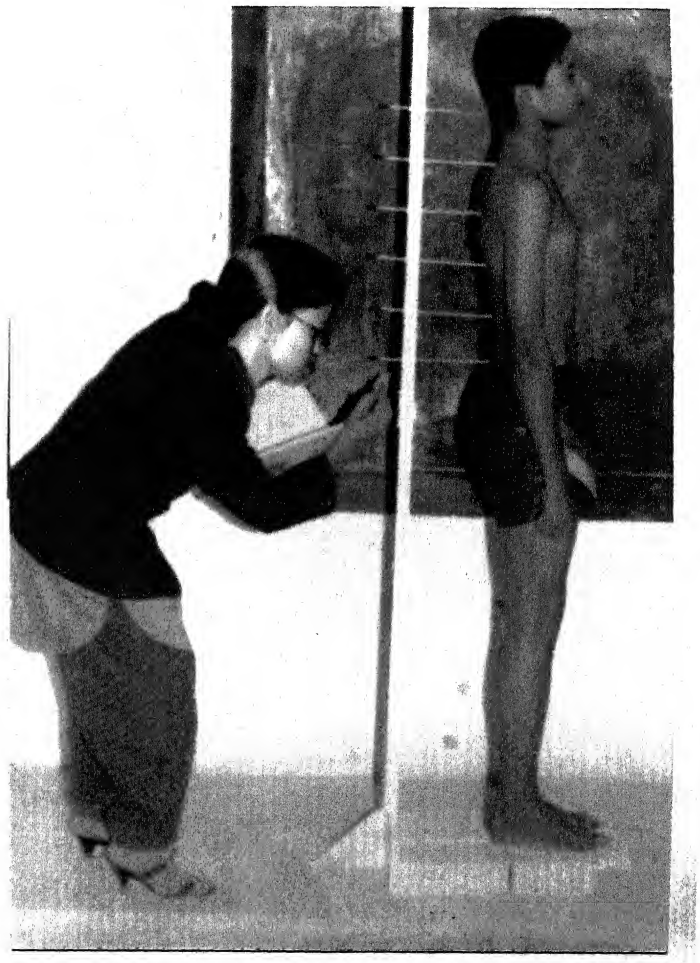

**Fig. 8 MEASUREMENT OF SPINAL CURVE – LORDOSIS.**

## Procedure of Identifying Students Suffering from Postural Deformities

The data collected with regard to identification of postural defects among the secondary school boys was statistically analysed by computing means and standard deviations with respect to each deformity score. To identify subjects suffering from postural defects one standard deviation on either side of mean was taken. Those who fell within mean ± 1 S.D. were treated as normal subjects and all others were considered as subjects having postural deformity/ deformities namely : Scoliosis, Kyphosis and Lordosis.

## Administration of Kraus-Weber Test

For each of the postural defects, 20 subjects were selected at random and the Kraus-Weber Test administered to them strictly following the instructions given in the book application of measurement to Physical Education, written by H. Harrison Clarke and David H. Clarke.

### Test 1

Abdominal Plus – Strength of the abdominal plus psoas muscles. Subject took supine lying position hands behind neck; examiner held the feet down. Subject was asked to perform one sit-up. **See Fig. 9 & 10.**

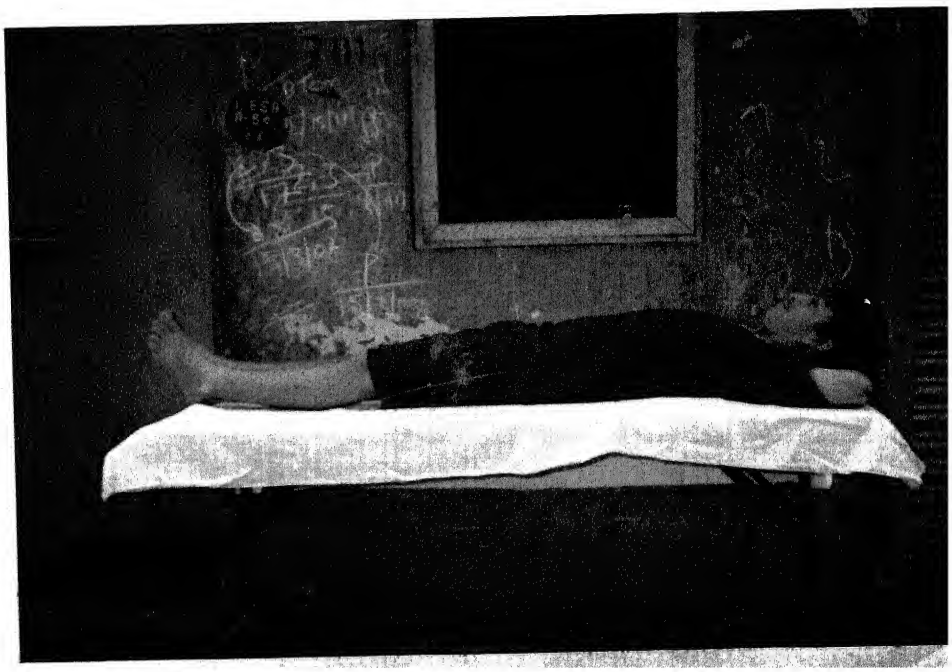

**Fig. 9 KRAUS-WEBER TEST (T 1) - ABDOMINAL PLUS – INITIAL POSITION.**

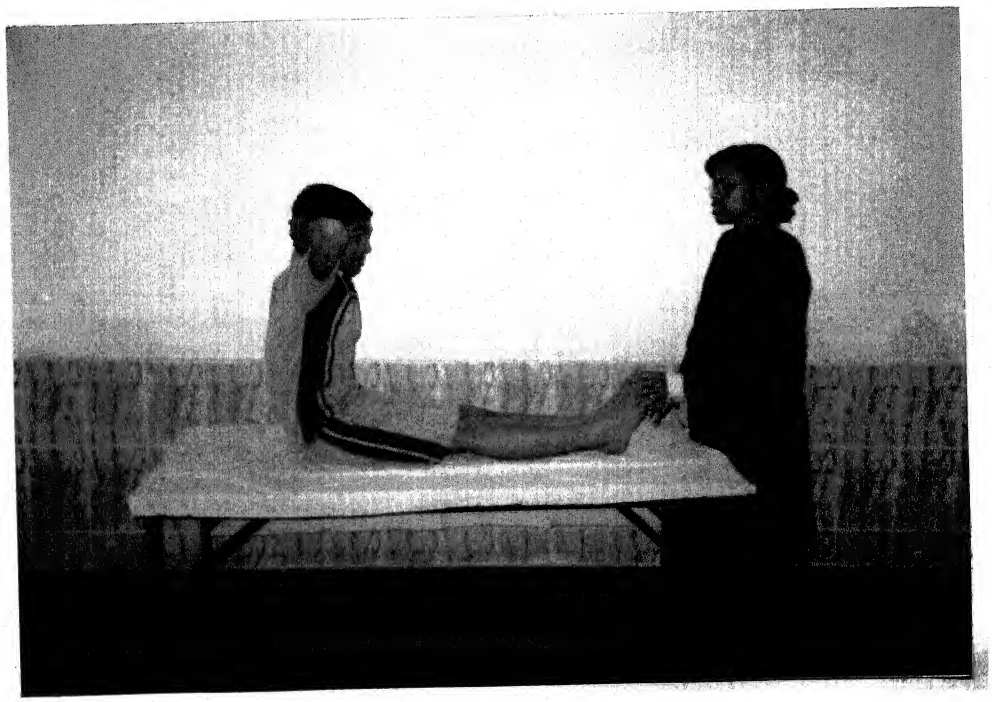

**Fig. 10 KRAUS-WEBER TEST (T 1)-ABDOMINAL PLUS-FINAL POSITION.**

Scoring - 0, when subject could not raise shoulders from table and 10 when full sit-up.

**Test 2**

Abdominal Minus – Strength of the abdominal minus psoas muscles. Subject took same supine position as Test 1, except knees were bent. Subject was asked to perform on sit-up.

Scoring - 0, when subject could not raise shoulders from table and 10 when full sit-up. **See Fig. 11 & 12.**

**Test 3**

Psoas and Lower Abdomen – Strength of psoas and lower abdominal muscles. Subject was asked to take supine lying position, hands behind neck; asked to raise feet 10 inches above the table surface for 10 sec.

Scoring – 0-10, done depending on the number of second position was held. **See Fig. 13.**

**Test 4**

Upper Back – Strength of upper back muscles – subject was made to take prone lying position with pillow under hips and lower abdomen, hands behind neck. Examiner held the feet down; subject was asked to raise chest, head, and shoulders while examiner counted to 10 sec. **See Fig. 14.**

Scoring – 0-10, done depending on the number of second position was held.

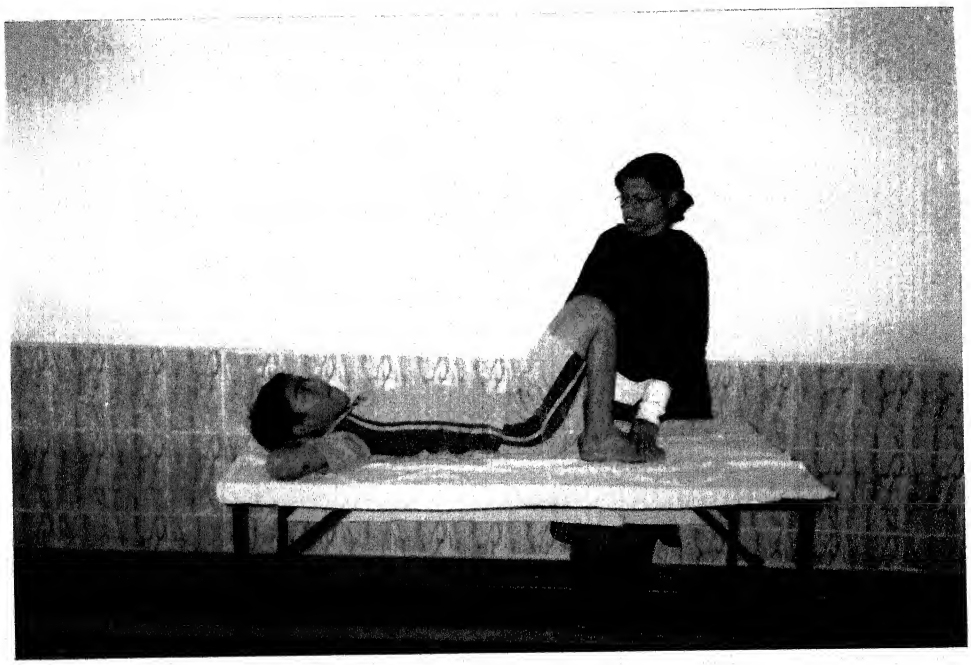

**Fig. 11 KRAUS-WEBER TEST (T 2)-ABDOMINAL MINUS-INITIAL POSITION.**

**Fig. 12 KRAUS-WEBER TEST (T 2)-ABDOMINAL MINUS-FINAL POSITION.**

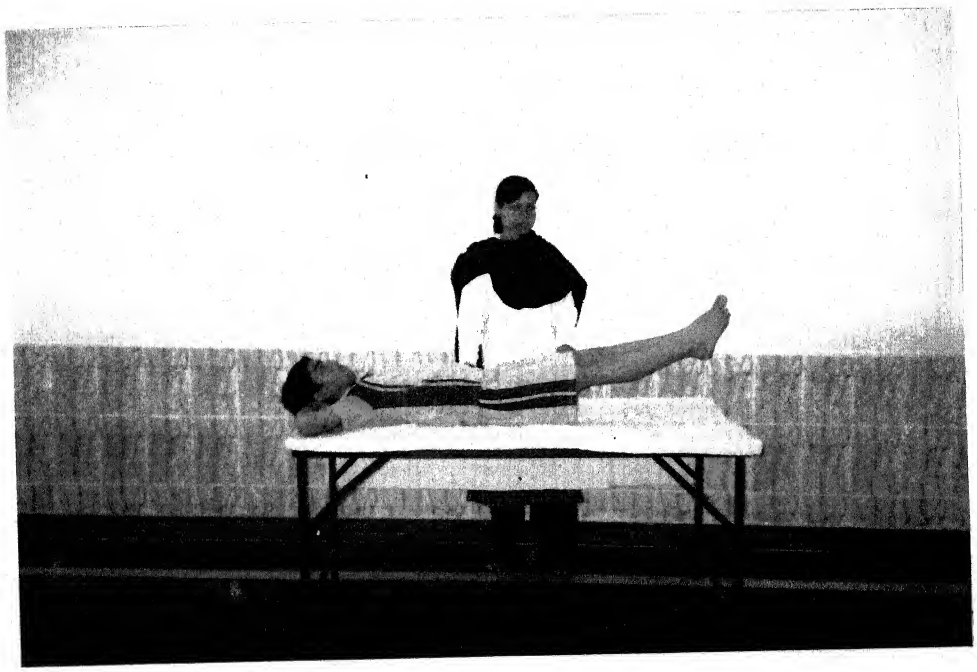

**Fig. 13 KRAUS - WEBER TEST (T 3) - PSOAS AND LOWER ABDOMINAL -FINAL POSITION.**

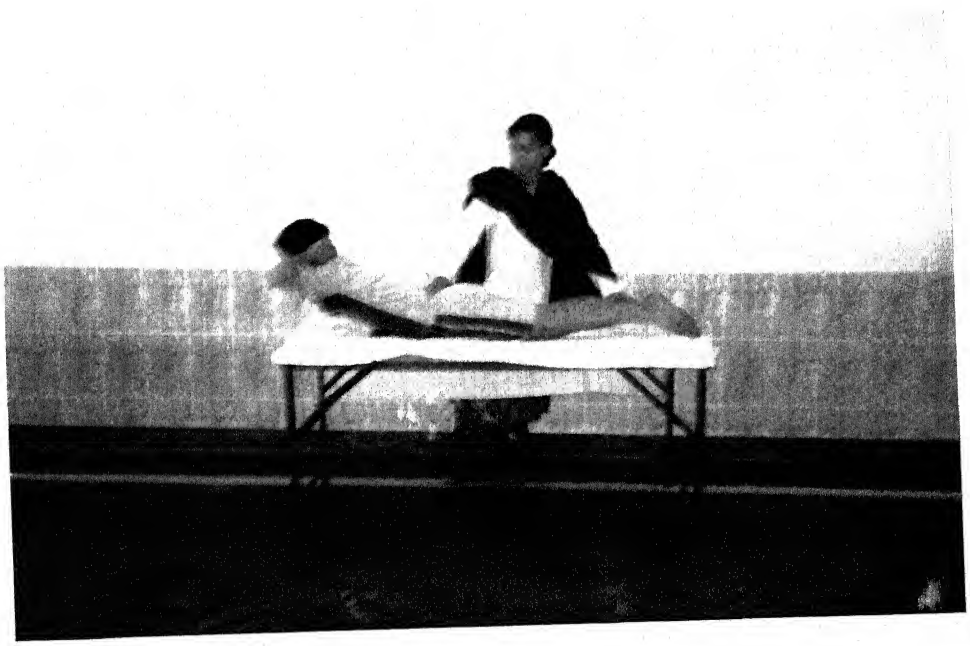

**Fig. 14 KRAUS-WEBER TEST (T 4)- UPPER BACK FINAL POSITION.**

**Test 5**

Lower Back – Strength of lower back muscles. Subject was asked to remain in same position as Test 4, except feet were raised with knees straight.

Scoring – 0-10, done depending on the number of second position was held. **See Fig. 15.**

**Test 6**

Length of Back and Hamstring Muscles: Trunk Flexibility or floor-touch test – subject stood erect on stocking or bare feet with hands on sides, feet together; subject was asked to lean down slowly and touch floor with finger tips for 3 seconds (bouncing was not allowed); examiner held knees in order to prevent any bend and to detect even any slight bend if it occurred.

Scoring – 10, reached floor and held position for 3 seconds. 0, distance reached 10 or more inches from floor. **See Fig. 16**

**Administration of Corrective Programme**

The scholar had discussions with orthopaedic surgeon and experts of corrective physical education and sports medicine regarding the conditioning programme for those suffering from postural defects. The programme was administered to subjects for a period of twelve weeks. Set of exercises was prepared according to deformity. In each set of exercises, five exercises were selected for conditioning programme. Each exercise was done with ten

**Fig. 15 KRAUS-WEBER TEST (T 5)- LOWER BACK FINAL POSITION.**

**Fig. 16 KRAUS-WEBER TEST (T 6)- LENGTH OF BACK AND HAMSTRING MUSCLES-FINAL POSITION.**

repetitions and each exercise was to hold for five seconds. In second week 20 repetitions were performed and for each exercise and the hold was increased to ten seconds. In the third week 30 repetitions were performed for each exercises; hold was maintained at 10 seconds with rest in between from 5 to 10 seconds after each exercise with 10 repetitions. In the fourth week 30 repetitions were maintained for each exercise as done in the 3rd week. Then from fifth week to twelveth week same repetitions were followed with 10 seconds with 10 seconds rest after each repetition. The research scholar demonstrated the correct way of standing, sitting and lying with an instruction that students should strictly follow these postures in order to have optimal effect of the conditioning programme.

**Flat-Foot**

Flat-foot exercises were meant to strengthen the arches of the foot/feet. The exercises were done in lying, sitting and standing position.

1. Lying on back, bend and abduct knees, bringing feet sole to sole, hands at the sides performing "Namaste with feet." **See Fig. 17 & 18.**
2. Lying on back, hips flexed, with legs against wall bringing toes down as far as possible, hands kept at sides. **See Fig. 19 &20.**
3. Sitting position with feet six inches apart and parallel. Hands on knees. Pick up a marble with toes of left foot and placed it behind right heel. **See Fig. 21 & 22.**

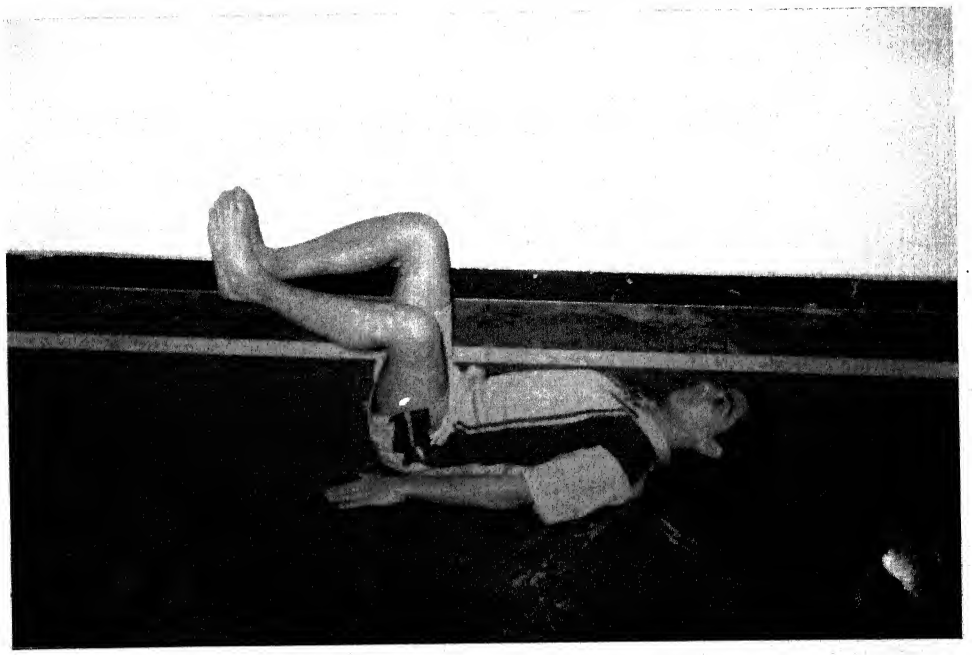

**Fig.17 EXERCISE FOR FLAT – FOOT SUBJECT PERFORMING NAMASTE WITH FEET.**

**Fig. 18 EXERCISE FOR FLAT – FOOT GROUP PERFORMING EXERCISE.**

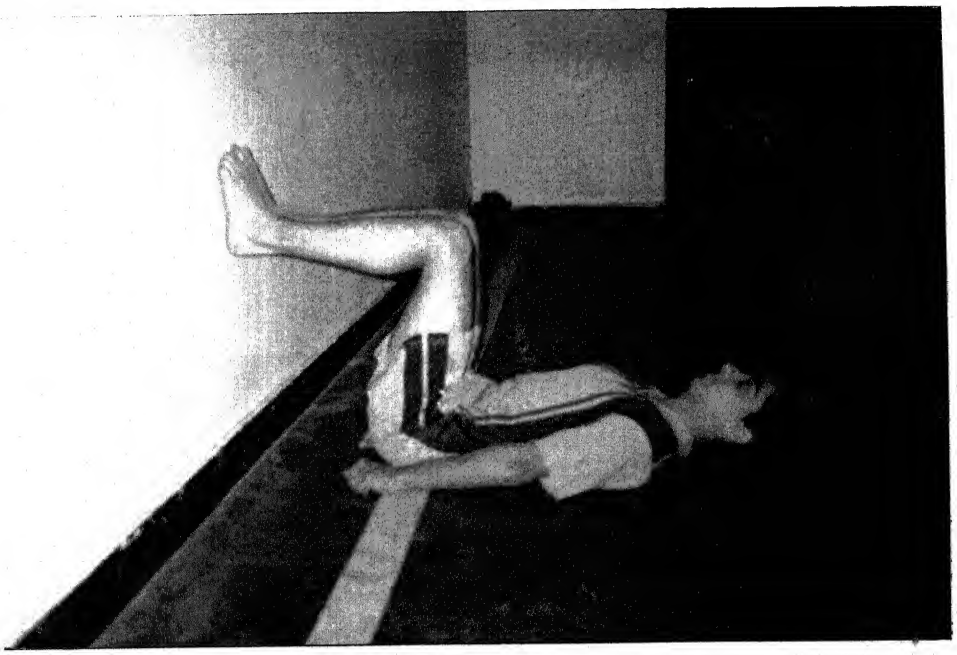

**Fig. 19 EXERCISE FOR FLAT–FOOT SUBJECT LOWERS THE TOES KEEPING FEET AGAINST THE WALL.**

**Fig. 20 EXERCISE FOR FLAT–FOOT GROUP PERFORMING EXERCISE.**

**Fig. 21 EXERCISE FOR FLAT–FOOT SUBJECT PICKING MARBELS WITH THE TOE.**

**Fig. 22 EXERCISE FOR FLAT – FOOT - GROUP PERFORMING EXERCISE.**

4. Sitting position with feet apart. Paper was spread on the floor and pressed with non-writing foot with hands on knees. Hold the pencil under the toe with its tip facing towards little finger and then to write in large strokes or bold letters. **See Fig. 23 & 24.**
5. Standing Position: Spread towel on the smooth floor. Keep heels on the ground and hands at sides. Use toes to pull towel under foot or sole. Place a book or any weight at the end of the other end of the towel. **See Fig. 25 & 26.**

**Scoliosis**

To strengthen the back and neck muscles, the following exercises were done in standing, lying and crawling position.

1. Subject takes long sit position, hands at shoulder level and the Palms facing front. This is the key position to start the exercise. Drop head forward with chin touching the collar bone. Palm facing downward, while inhaling and exhale while raising the head to its key position. **See Fig. 27, 28, 29 & 30.**
2. Long sit position, back touching the wall, hands stretched at shoulder level and palm touching the wall. This is the key position to start this exercise. Bend head to sides alternately touching shoulder with ears while inhaling. Hold position for 10 countings. Exhale while returning to the key position. Repeat exercise on other side also (while performing this exercise head and back should be move away from the wall. **See Fig. 31, 32 & 33.**

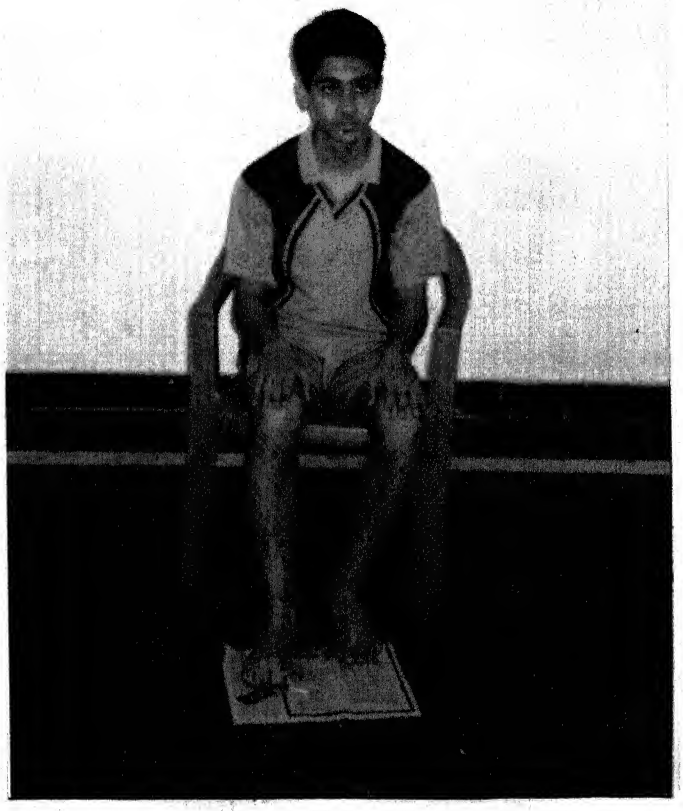

**Fig. 23 EXERCISE FOR FLAT–FOOT–SUBJECT WRITING WITH PENCIL HELD BETWEEN TOES.**

**Fig. 24 EXERCISE FOR FLAT – FOOT GROUP PERFORMING EXERCISE.**

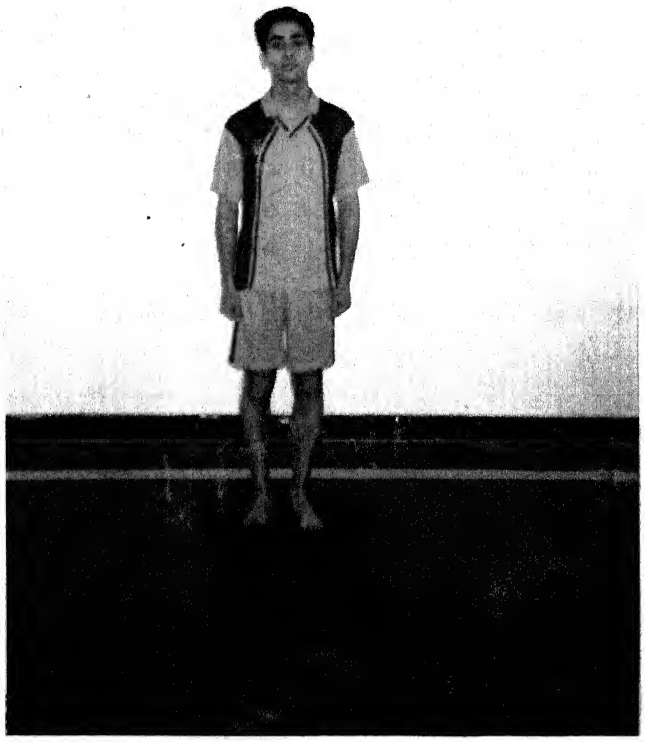

**Fig. 25 EXERCISE FOR FLAT – FOOT – SUBJECT PULLING TOWEL WITH TOES.**

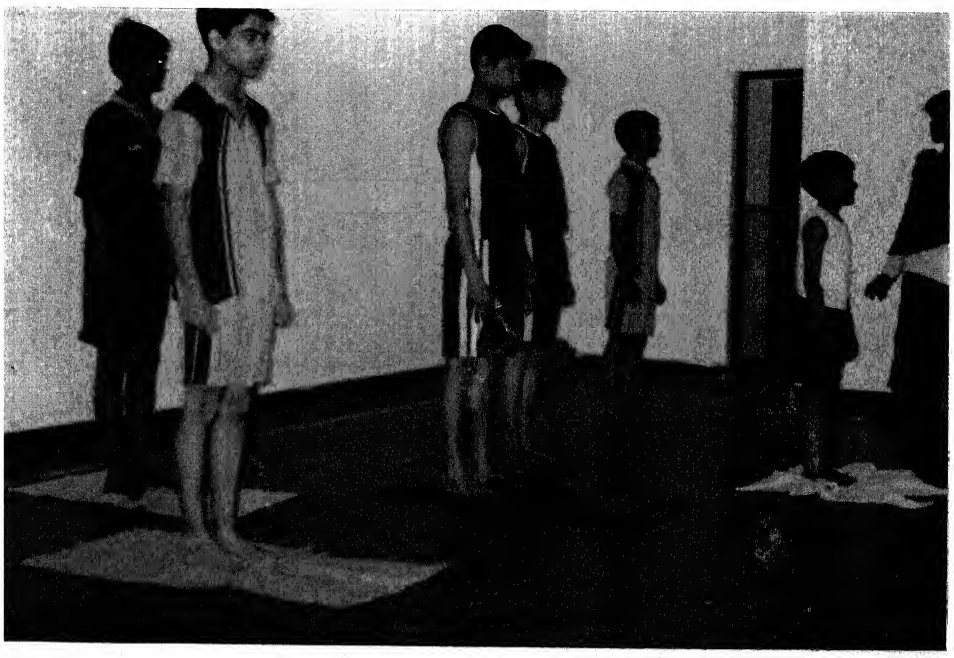

**Fig. 26 EXERCISE FOR FLAT – FOOT GROUP PERFORMING EXERCISE.**

**Fig. 27 EXERCISE FOR SCOLIOSIS – SUBJECT IN READY POSITION FOR DROPPING HEAD FORWARD DOWNWARD.**

**Fig. 28 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING EXERCISE.**

**Fig. 29 EXERCISE FOR SCOLIOSIS – SUBJECT LOWERING THE HEAD FORWARDDOWN WARD PALM FACING THE FLOOR.**

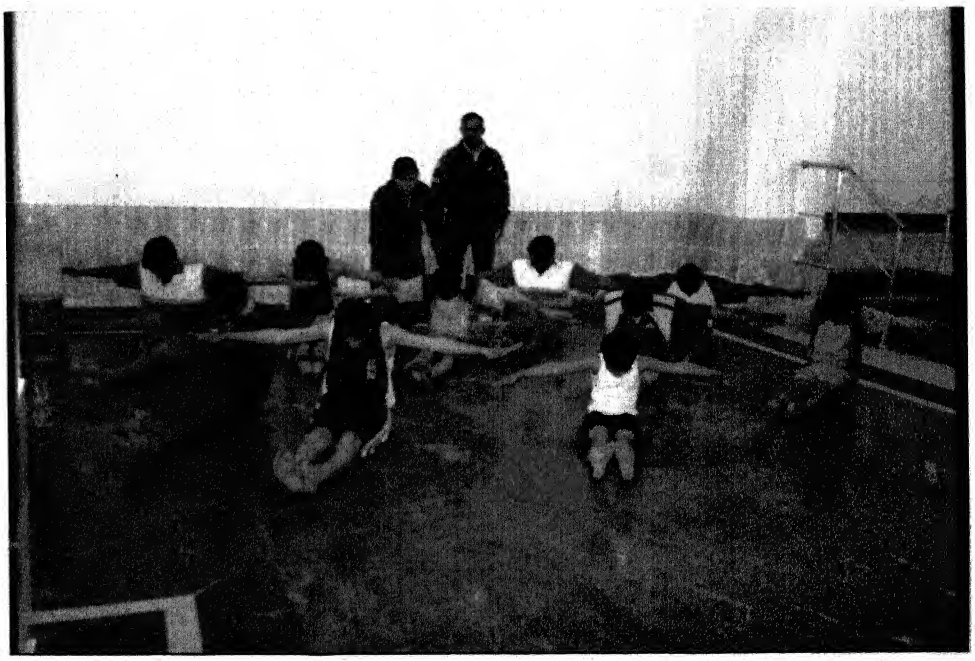

**Fig. 30 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING THE ABOVE EXERCISE.**

**Fig. 31 EXERCISE FOR SCOLIOSIS – SUBJECTS SITTING AGAINST THE WALL IN READY POSITION FOR BENDING HEAD SIDEWAYS.**

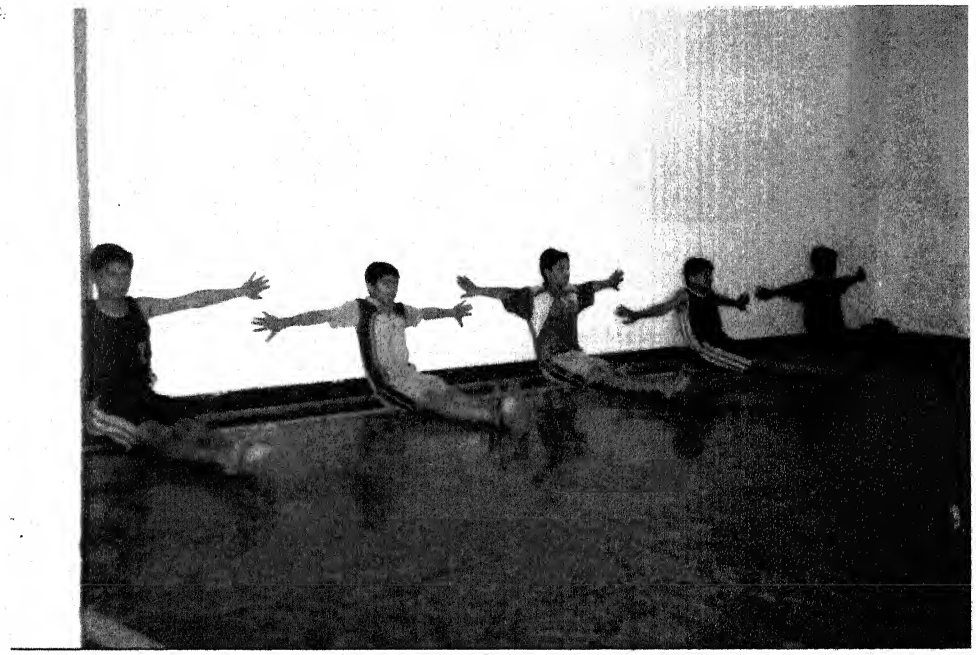

**Fig. 32 EXERCISE FOR SCOLIOSIS – SUBJECTS BENDING HEAD SIDEWAYS WHILE SITTING AGAINST THE WALL.**

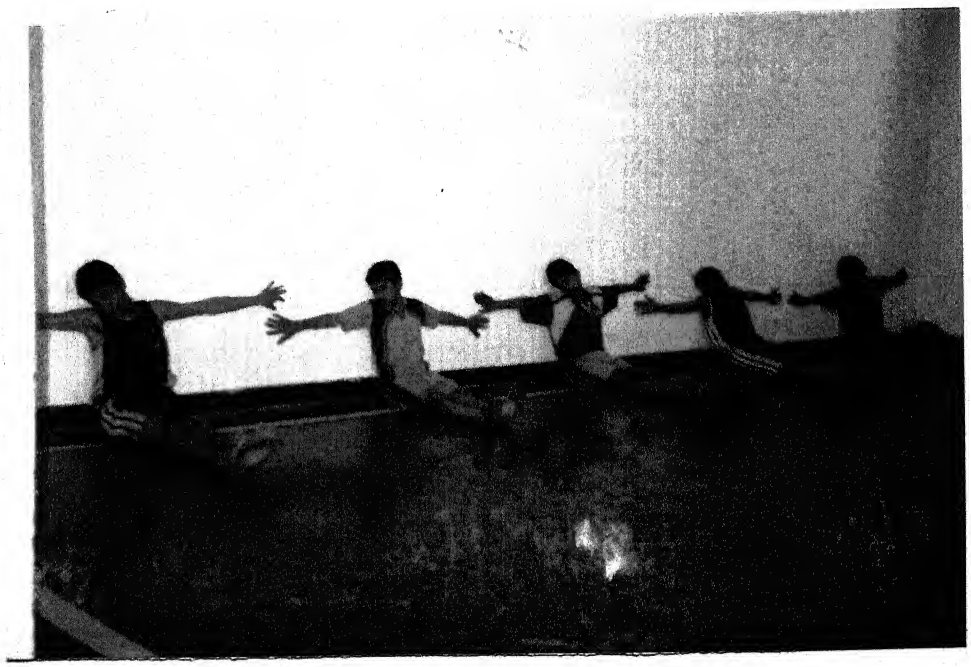

**Fig. 33 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING EXERCISE.**

3. Lying position is prone with hands at sides and the trunk and lower extremities deviated towards the side of the lumbar convexity and shrug the hip up on that side, while raising the opposite arm high over the head and placing the other hand over the convexity. **See Fig. 34 & 35.**
4. Crawling on the hands and knees, the knee on the side of the lumbar convexity is forward and the opposite leg is stretched backward and inward. The arms on the side of the concavity are extended forward and inward. **See Fig. 36 & 37.**
5. In standing position – lift the hip on the side of the lumbar convexity by raising the same heel. Stretch the opposite arm high over the head while the other hand pressing on the convexity. **See Fig. 38 & 39.**

## Kyphosis

Kyphosis exercises done to strengthen dorsal muscles: These exercises were done in sitting and lying position.

1. Patient lies supine with arms at sides, a small towel folded between the shoulder blades. Raise the arms forward and upward over the head while inhaling, lower arms downward and to sides while exhaling. **See Fig. 40 & 41.**
2. Prone lying position – inhale while raising the head and chest from the floor with hands clasped behind the neck, elbows well back, hold until five counts. Exhale slowly while lowering head and chest. **See Fig. 42 & 43.**

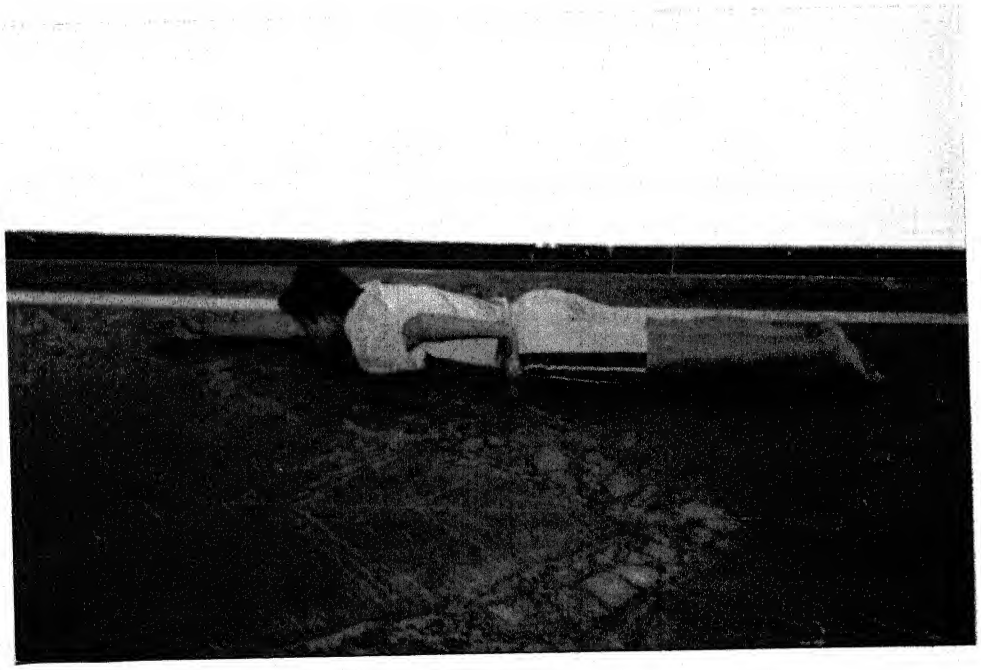

**Fig. 34 EXERCISE FOR SCOLIOSIS – SUBJECTS IN PRONE LYING POSITION AND DEVIATING TRUNK AND LOWER EXTEMITIES SIDEWARDS.**

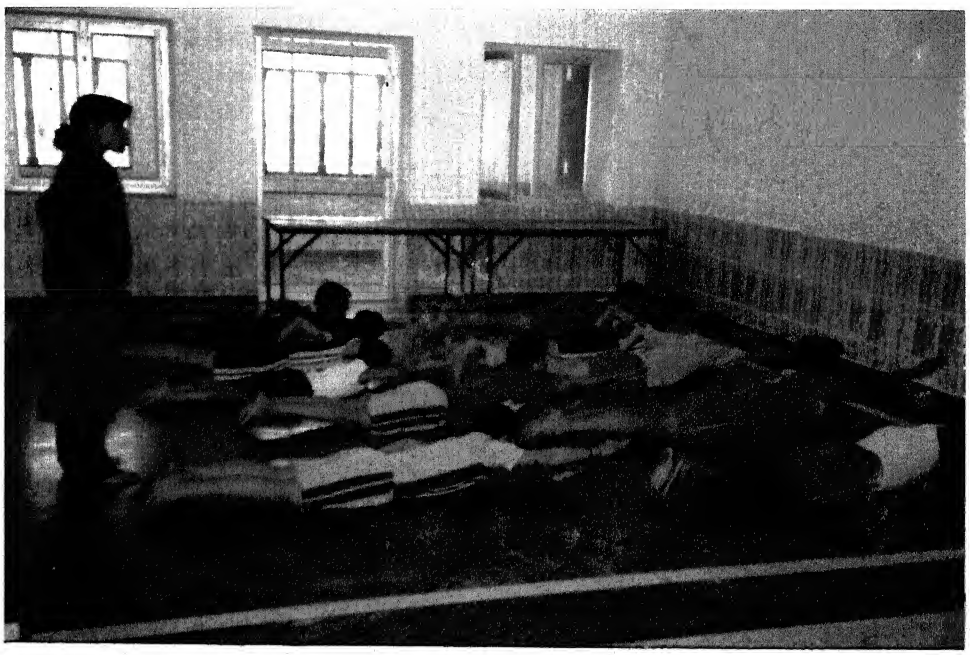

**Fig. 35 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING EXERCISE.**

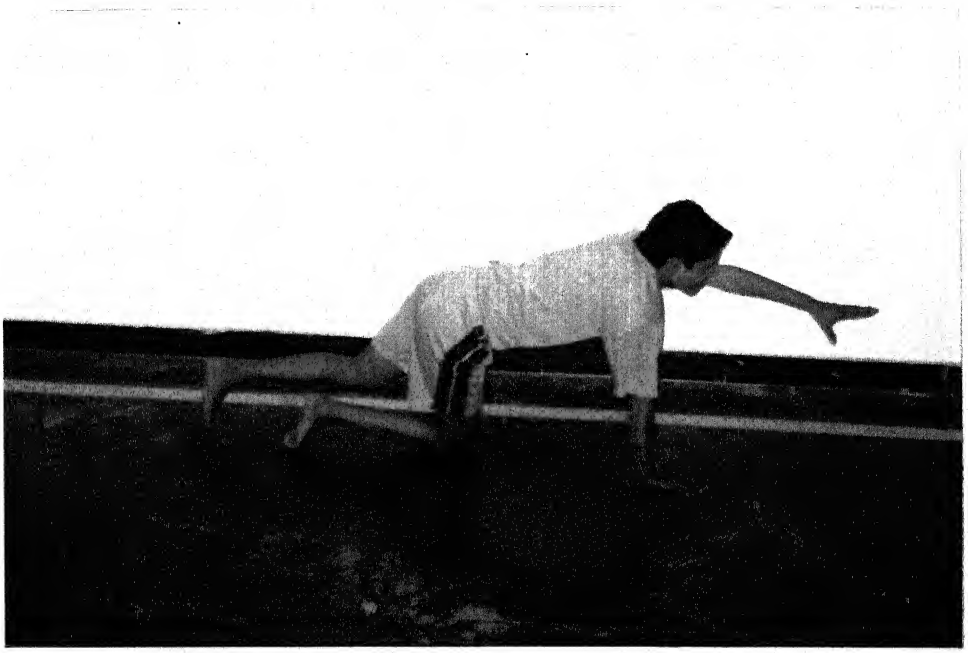

**Fig. 36 EXERCISE FOR SCOLIOSIS – SUBJECT CRAWLING ON HANDS AND FEET.**

**Fig. 37 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING EXERCISE.**

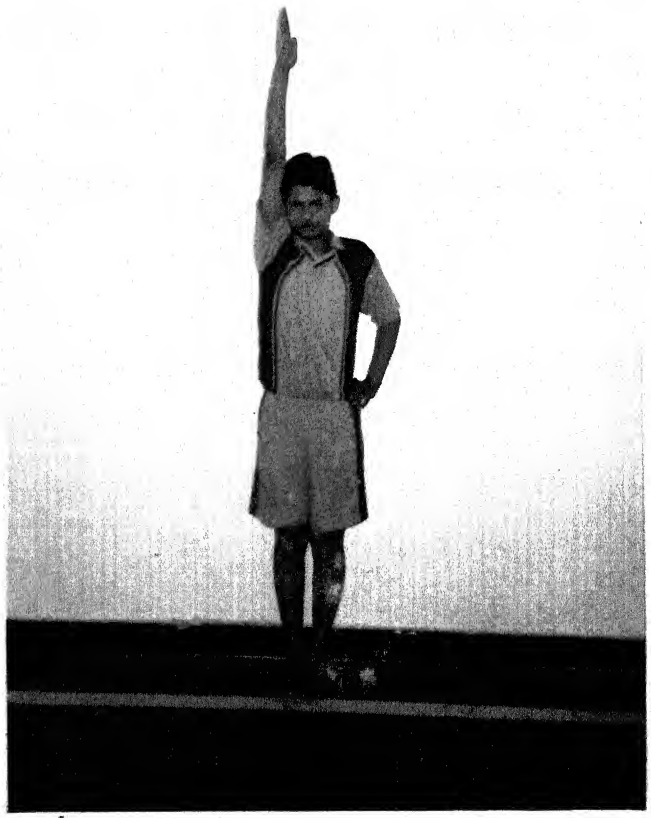

**Fig. 38 EXERCISE FOR SCOLIOSIS – SUBJECT STRETCHING ARMS OVER HEAD.**

**Fig. 39 EXERCISE FOR SCOLIOSIS – GROUP PERFORMING EXERCISE.**

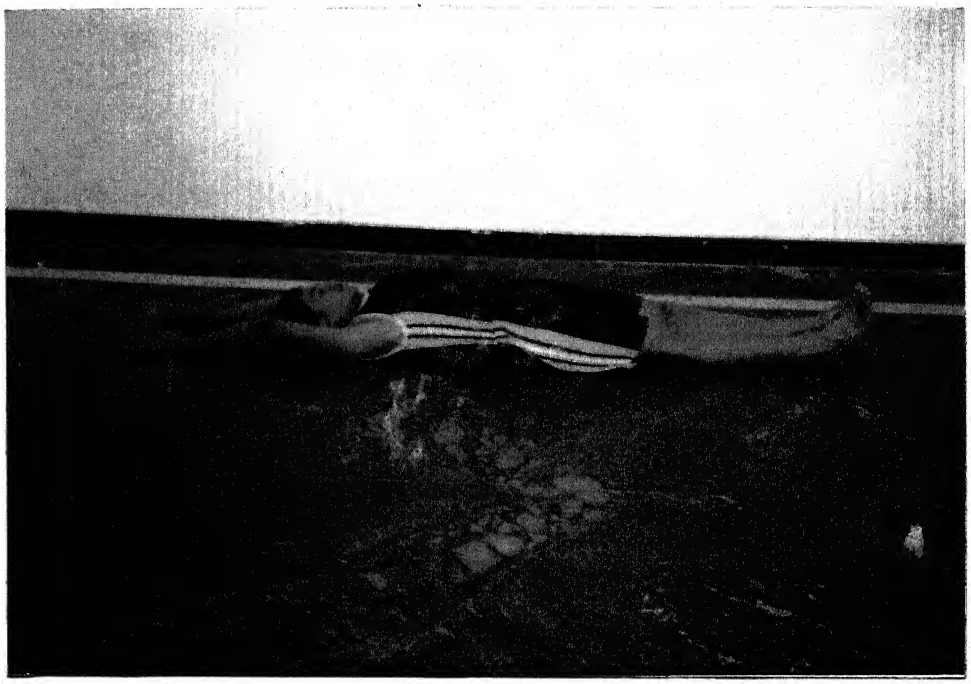

**Fig. 40 EXERCISE FOR KYPHOSIS –SUBJECT IN SUPINE LYING POSITION AND RISING ARMS UPWARD DOWNWARD.**

**Fig. 41 EXERCISE FOR KYPHOSIS – GROUP PERFORMING EXERCISE.**

**Fig. 42 EXERCISE FOR KYPHOSIS –SUBJECT RAISING HEAD AND SHOULDERS FROM PRONE LYING POSITION KEEP HANDS CLASPED BEHIND THE NECK.**

**Fig. 43 EXERCISE FOR KYPHOSIS – GROUP PERFORMING EXERCISE.**

3. Prone lying position with arms extended over the head. Raise the arms, head and chest from the floor, hold upto five counts, inhaling going up and exhaling coming down. **See Fig. 44 & 45.**
4. In sitting position (long sit) neck firm, hands kept behind neck, stretch the head, chest and neck upward as far as possible; at the same time raising the elbows upto the maximum. Inhale going up and exhale coming down. **See Fig. 46 & 47.**
5. In sitting position with hands clasped behind lower back, bring the shoulders together by pulling don ward and inward with arms. Head is held back during the exercise. Caution does not allow hips to move forward. **See Fig. 48 & 49.**

**Lordosis**

To strengthen abdominal and back muscle (lumbar muscles) the following exercises were done in lying and standing positions.

1. Subject lies in prone position with hands at sides and chin on the ground. Keep both the legs straight with toes together, pointing outward. The exercise starts from this position. Now tighten the gluteal muscles and hold the position upto ten counts. **See Fig. 50 & 51.**
2. Same position as exercise on lying in prone. Stretch the legs together and ZASCraise the legs alternately one by one above the floor. Then raise both the legs together and hold in position for ten counts. (in Salabhasana). **See Fig. 52, 53, 54 & 55.**

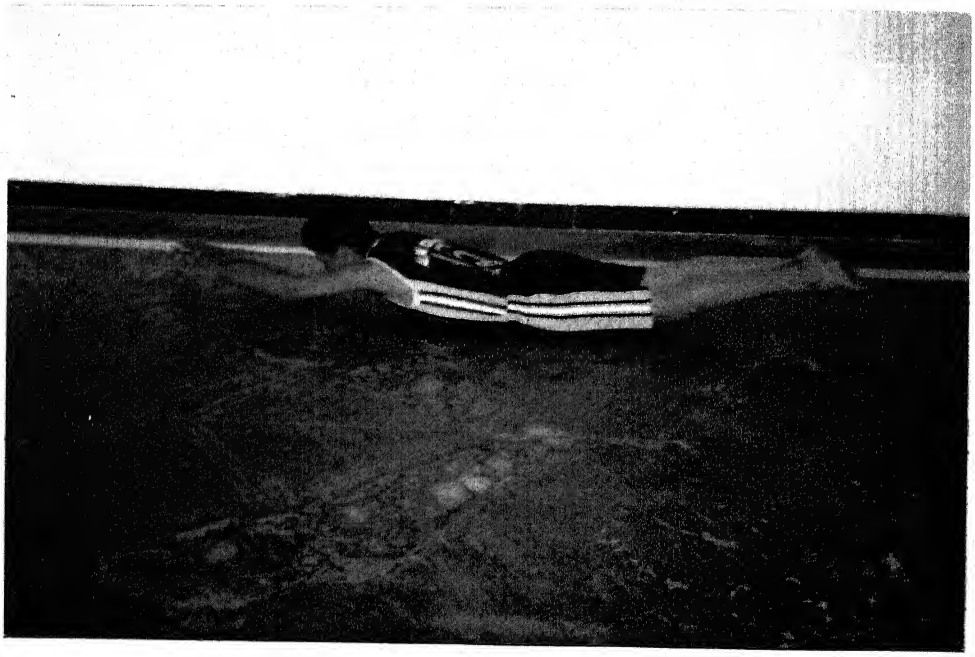

**Fig. 44 EXERCISE FOR KYPHOSIS–SUBJECT IN PRONE LYING POSITION WITH ARMS EXTENDED OVER HEAD AND RAISES ARMS, HEAD AND CHEST FROM THE FLOOR.**

**Fig. 45 EXERCISE FOR KYPHOSIS – GROUP PERFORMING EXERCISE.**

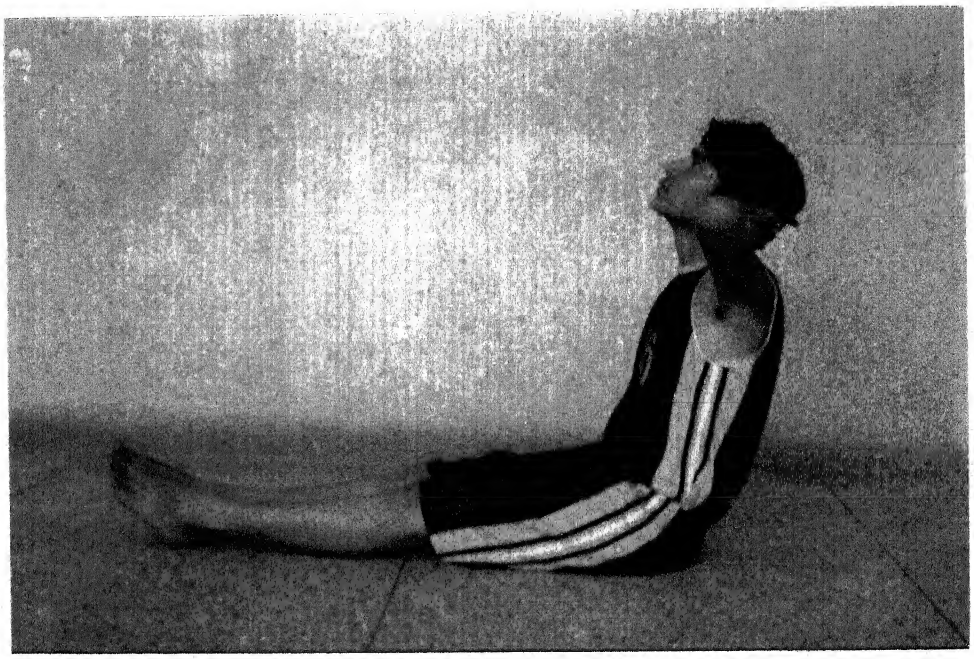

**Fig. 46 EXERCISE FOR KYPHOSIS – SUBJECT FROM LONG SITTING POSITION STRETCHES THE HEAD, CHEST AND NECK UPWARD**

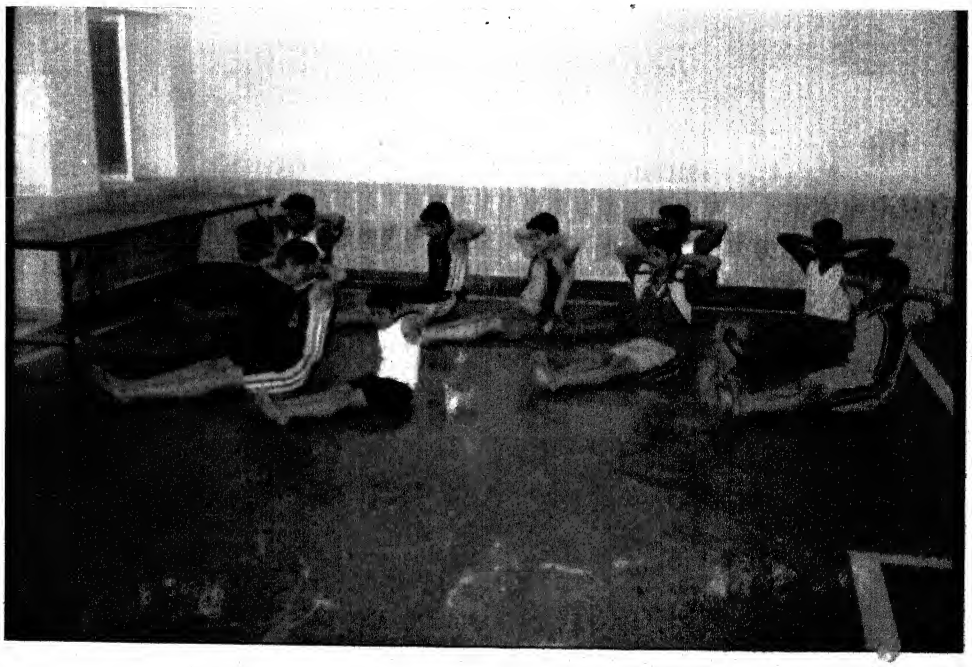

**Fig. 47 EXERCISE FOR KYPHOSIS – GROUP PERFORMING EXERCISE.**

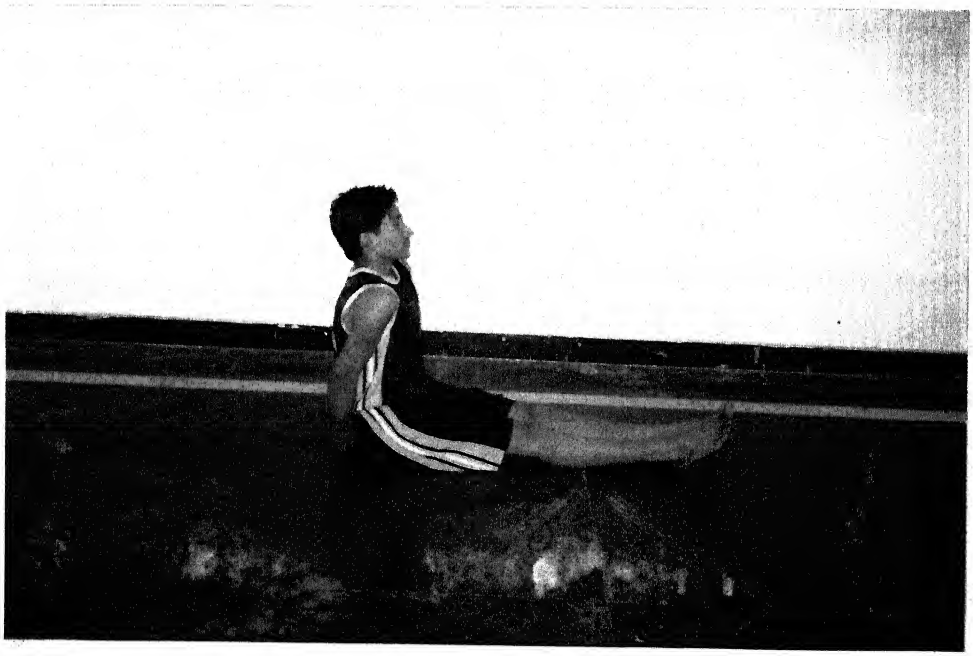

**Fig. 48 EXERCISE FOR KYPHOSIS – SUBJECT FROM LONG SITTING POSITION WITH HANDS CLASPED BEHIND LOWER BACK BRING THE SHOULDERS DOWNWARD AND INWARD WITH ARMS.**


**Fig. 49 EXERCISE FOR KYPHOSIS – GROUP PERFORMING EXERCISE.**

**Fig. 50 EXERCISE FOR LORDOSIS –SUBJECT FROM PRONE LYING POSITION TIGHTENS THE GLUTEAL MUSCLES.**

**Fig. 51 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE.**

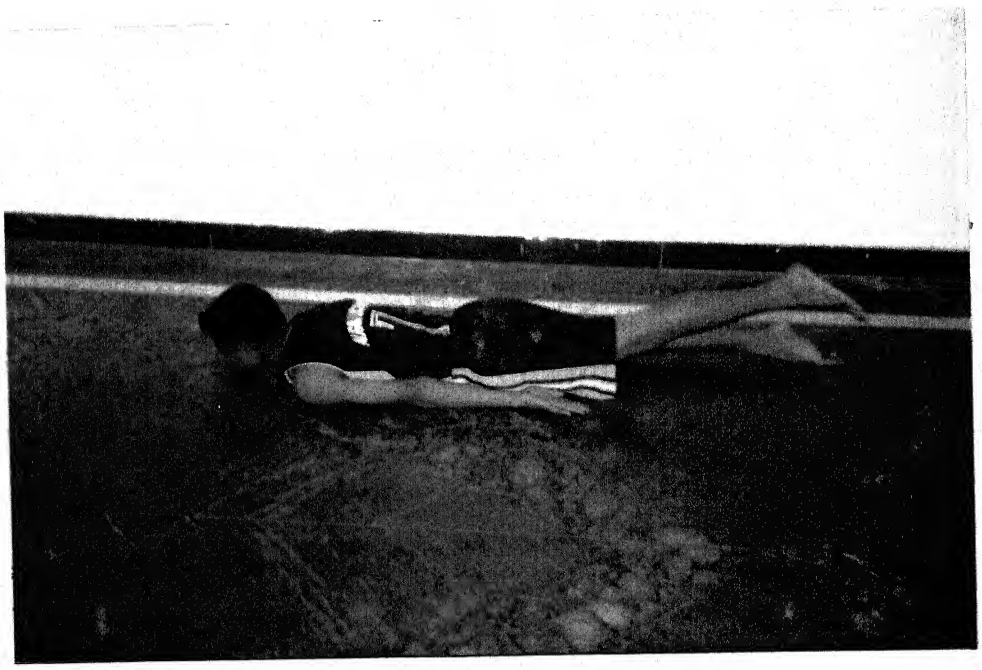

**Fig. 52 EXERCISE FOR LORDOSIS –SUBJECT FROM PRONE LYING POSITION THE SUBJECT RAISES LEGS ALTERNATELY.**

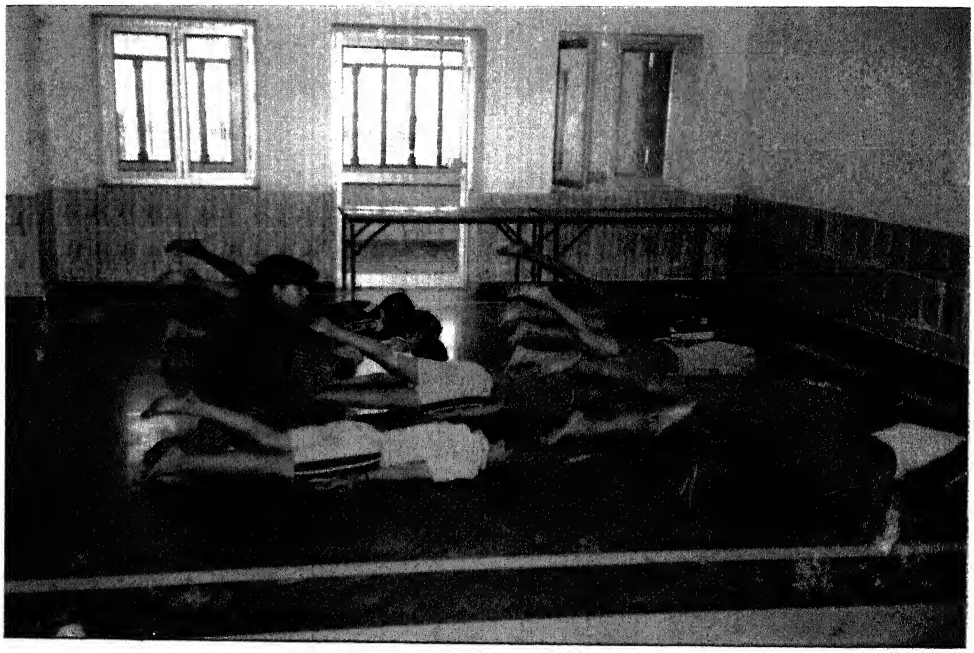

**Fig. 53 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE.**

**Fig. 54 EXERCISE FOR LORDOSIS – FROM PRONE LYING POSITION THE SUBJECT RAISES LEGS TOGETHER.**

**Fig. 55 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE.**

3. Lying Position – The patient lies supine, knees flexed, heels close to the buttocks and hands resting on the sides near the hip. The exercise starts from this position. Slowly bring the knees up over the chest and as close to the chin as far as possible. Care being taken not to raise the head during the exercise. Subject slowly and return to the key position. **See Fig. 56, 57 & 58.**
4. Standing Position – Shrug one hip and extend the thigh backward. Hands should be kept at shoulder level. Repeat the exercise on the other side. Do not turn or rotate the body with the hips (Keep T – balance). **See Fig. 59, 60, 61 & 62.**
5. Standing Position with feet slightly apart, clasp hands behind the neck, bend trunk side wards and rotate trunk from side to side. **See Fig. 63, 64, 65 & 66.**

## Statistical Procedure Used in the Study

Means and standard deviations in respect of each of the postural defects i.e. scoliosis, kyphosis and lordosis were computed in order to identify the normal children and those suffering from above defects. In order to determine the number of subjects suffering from postural defects, in relation to the population, a percentage analysis was done.

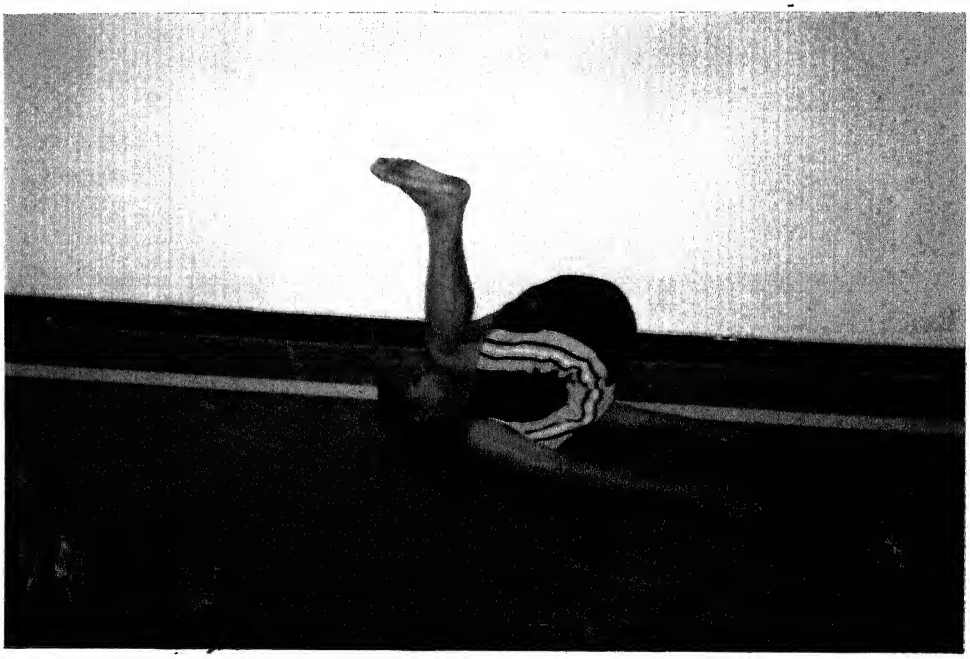

**Fig. 56 EXERCISE FOR LORDOSIS –SUBJECT IN READY POSITION FOR BRINGIN THE KNEES UP OVER THE CHEST CLOSE TO THE CHIN.**

**Fig. 57 EXERCISE FOR LORDOSIS –SUBJECT FROM SUPINE LYING WITH KNEES FLEXED BRINGIN THE KNEES UP OVER THE CHEST CLOSE TO THE CHIN.**

**Fig. 58 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE**

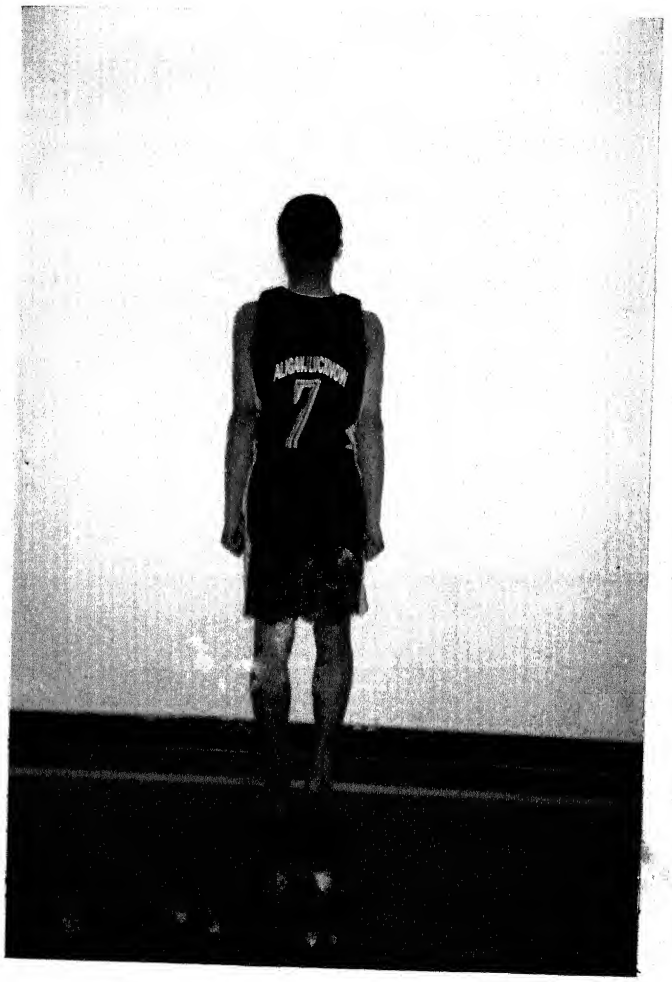

**Fig. 59 EXERCISE FOR LORDOSIS – SUBJECT IN READY POSITION FOR ALTERNATE HIP SHURGING AND BACKWARD EXTENSION OF THIGH.**

**Fig. 60 EXERCISE FOR LORDOSIS – GROUP PERFORMING MOVEMENT**

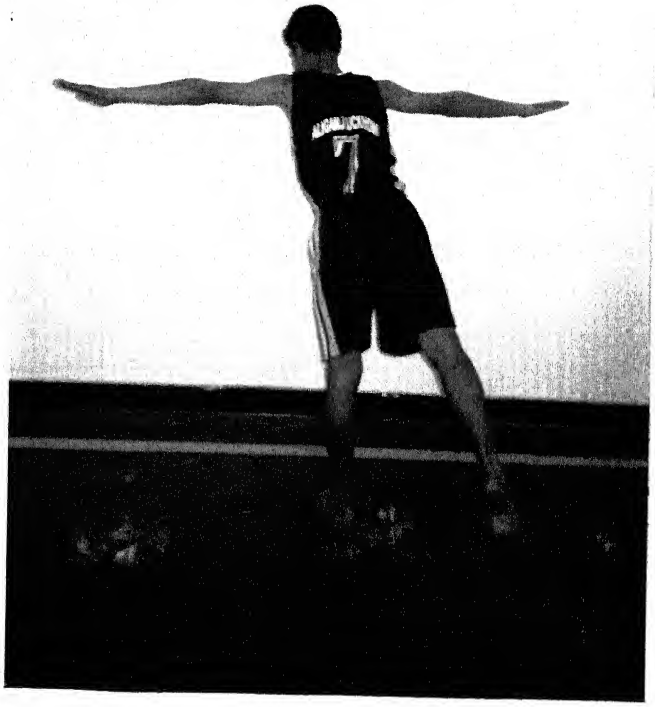

**Fig. 61 EXERCISE FOR LORDOSIS – SUBJECT EXTENDS THIGH BACKWARD AND MAINTAIN 'T' BALANCE.**

**Fig. 62 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE**

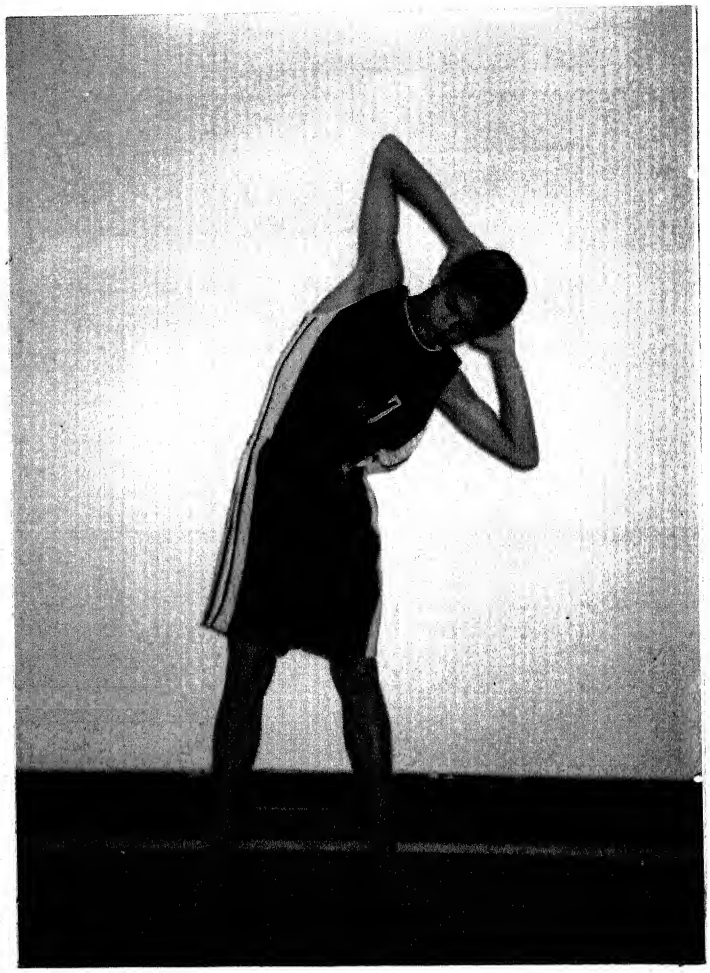

**Fig. 63 EXERCISE FOR LORDOSIS – SUBJECT BENDS THE TRUNK TO THE LEFT SIDE KEEPING HANDS CLASPED BEHIND THE NECK.**

**Fig. 64 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE**

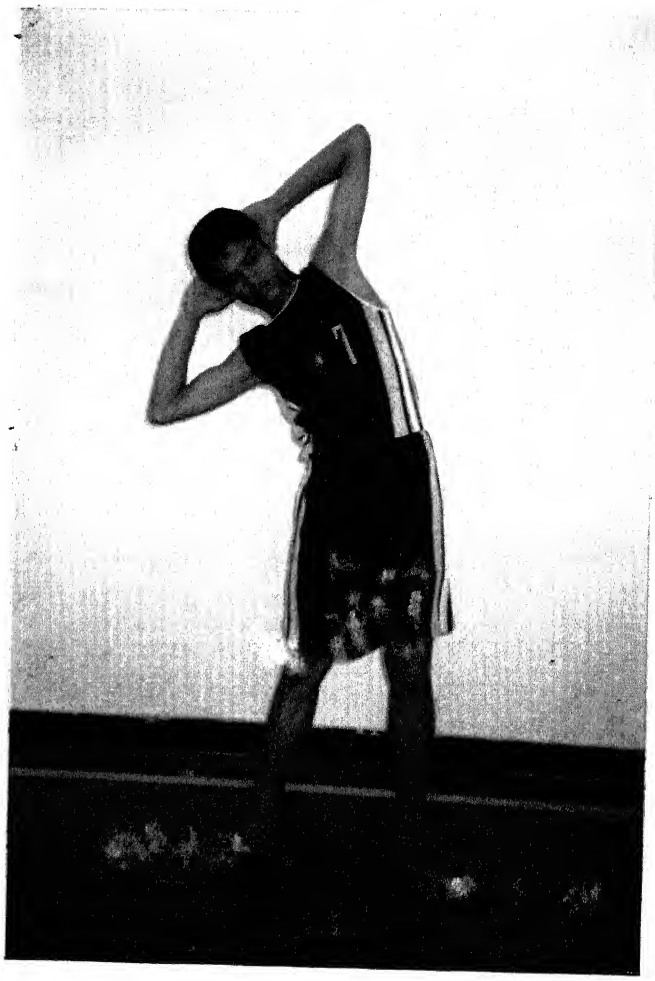

**Fig. 65 EXERCISE FOR LORDOSIS – SUBJECT BENDS THE TRUNK TO THE RIGHT SIDE KEEPING HANDS CLASPED BEHIND THE NECK.**

**Fig. 66 EXERCISE FOR LORDOSIS – GROUP PERFORMING EXERCISE**

Chapter IV

# ANALYSIS OF DATA RESULTS OF THE STUDY

The research Scholar had tested 1006 subjects to ascertain postural abnormalities. After testing the subjects it was observed that the subjects fell under 3 categories i.e. subjects suffering from single deformities, subjects suffering from multiple deformities, subjects with normal posture, details of subjects with single deformities, multiple deformities and normal posture are given in Table 1.

**TABLE 1.**

**PERCENTAGE OF SUBJECTS WITH SINGLE DEFORMITIES, MULTIPLE DEFORMITIES AND NORMAL POSTURE**

| Deformity | No. of Subjects | Percentage |
|---|---|---|
| Single Deformities | 160 | 15.90% |
| Multiple Deformities | 164 | 16.30% |
| Normal Posture | 682 | 67.79% |

From the above Table it is evident that out of 1006 subjects tested by the scholar, 15.90 percent suffered from single deformities, 16.30 percent suffered from multiple deformities and 67.79 percent were normal subjects. **See Fig. 67.**

In the present study subjects suffering from single deformities only have been taken into consideration in order to study the effect of conditioning and corrective programme.

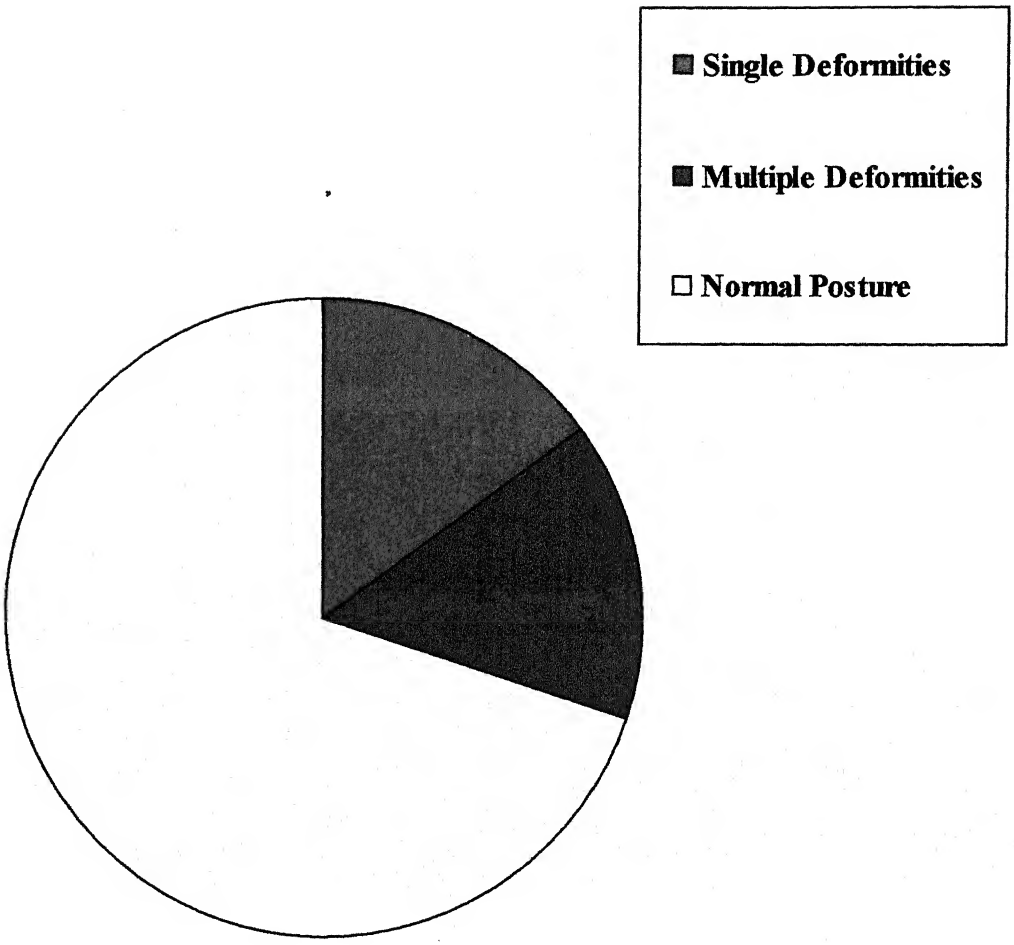


Fig. 67 NUMBER OF SUBJECTS WITH SINGLE DEFORMITIES, MULTIPLE DEFORMITIES AND NORMAL POSTURE

The break-up of subjects suffering from single deformities i.e. Flat-foot, Scoliosis, Kyphosis and Lordosis alongwith their percentage are given in Table 2.

**TABLE 2.**

**PERCENTAGE OF SUBJECTS SUFFERING FROM DIFFERENT POSTURAL DEFECTS**

| Nature of Defect | No. of Subjects | Percentage |
|---|---|---|
| Flat-foot | 20 | 1.98% |
| Scoliosis | 24 | 2.38% |
| Kyphosis | 75 | 7.45% |
| Lordosis | 41 | 4.07% |

From the above Table it is observed that out of 1006 subjects 1.98 percent suffered from Flat-foot, 2.38 percent suffered from Scoliosis, 7.45 percent suffered from Kyphosis and 4.07 percent suffered from Lordosis. It is noted that maximum subjects suffered from Kyphosis and minimum number of subjects suffered from Flat-foot in the age group of 14 to 16 years. **See Fig. 68.**

20 subjects suffering from each deformity were selected at random by the research scholar. They are given Kraus-weber Test before imparting the corrective programme. The performance of the subjects in the test is given in Tables 3, 4, 5 and 6.

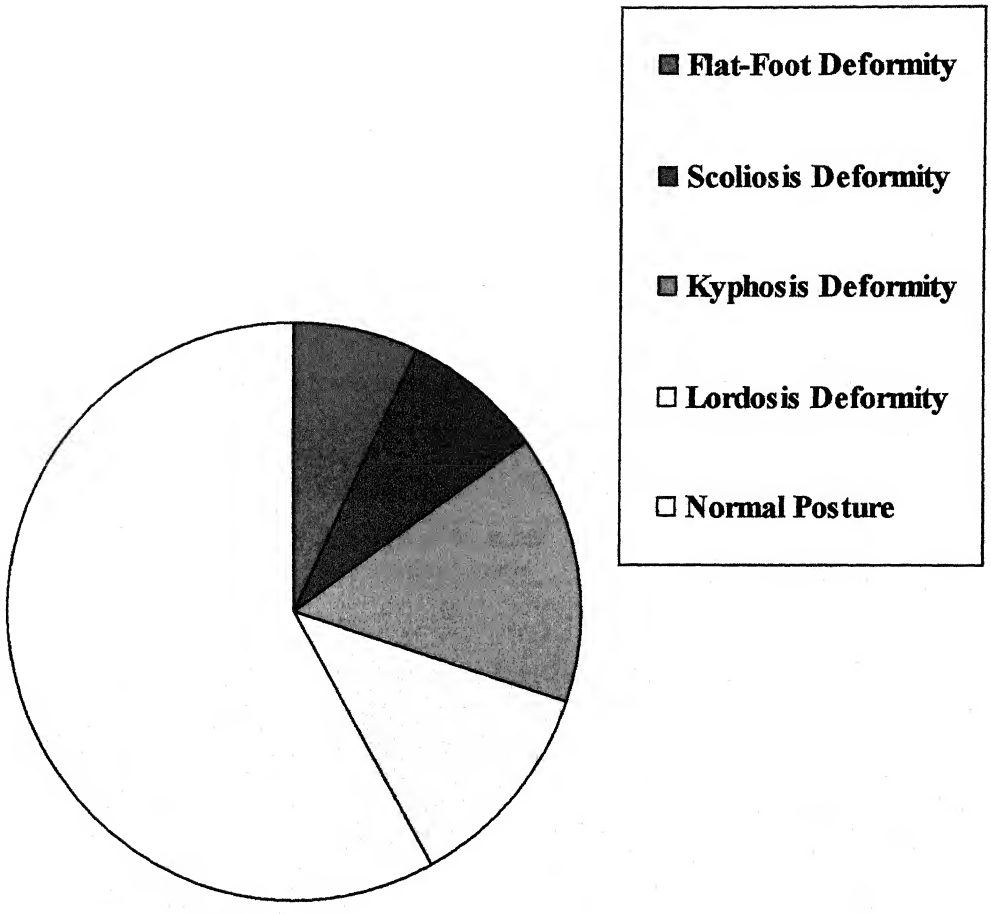


Fig. 68 NUMBER OF SUBJECTS WITH AND WITHOUT POSTURAL DEFORMITIES IN RELATIONTO TOTAL NUMBER OF SUBJECTS SELECTED FOR THE STUDY

## TABLE 3.

## RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM FLAT-FOOT

| Deformity | No. of subjects tested | Test | No. of subject failed | Percentage |
|---|---|---|---|---|
| Flat-foot | 20 | T 1 Abdominal Plus | NIL | NIL |
| | | T 2 Abdominal Minus | 5 | 25% |
| | | T 3 Psoas and Lower Abdomen | 13 | 65% |
| | | T 4 Upper Back | 1 | 5% |
| | | T 5 Lower Back | 8 | 40% |
| | | T 6 Length of Back and Hamstring Muscle | 5 | 25% |

From the above Table it is observed that in the test abdominal plus (T 1) all the subjects passed whereas with regards to abdominal minus (T 2), Psoas and Lower abdomen (T 3), Upper back (T 4), Lower back (T 5), and length of back and Hamstring Muscles (T 6) 25 percent, 65 percent, 5 percent, 40 percent and 25 percent respective failed to pass the test.

## TABLE 4.

## RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM SCOLIOSIS

| Deformity | No. of subjects tested | Test | No. of subject failed | Percentage |
|---|---|---|---|---|
| Scoliosis | 20 | T 1 Abdominal Plus | NIL | NIL |
| | | T 2 Abdominal Minus | NIL | NIL |
| | | T 3 Psoas and Lower Abdomen | 9 | 45% |
| | | T 4 Upper Back | 14 | 70% |
| | | T 5 Lower Back | 12 | 60% |
| | | T 6 Length of Back and Hamstring Muscle | 7 | 35% |

From the above Table it is evident that test abdominal plus (T 1) and abdominal minus (T 2), were cleared by all the subjects whereas Psoas and Lower abdomen (T 3), Upper back (T 4), Lower back (T 5), and length of back and Hamstring Muscles (T 6) 45 percent, 70 percent, 60 percent and 35 percent subjects failed to clear the test.

**TABLE 5.**

**RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM KYPHOSIS**

| Deformity | No. of subjects tested | Test | No. of subject failed | Percentage |
|---|---|---|---|---|
| Kyphosis | 20 | T 1 Abdominal Plus | NIL | NIL |
| | | T 2 Abdominal Minus | 10 | 50% |
| | | T 3 Psoas and Lower Abdomen | 7 | 35% |
| | | T 4 Upper Back | 9 | 45% |
| | | T 5 Lower Back | 9 | 45% |
| | | T 6 Length of Back and Hamstring Muscle | 2 | 10% |

It has been observed from the above Table all the subjects passed the test abdominal plus (T 1) but 50 percent failed to clear abdominal minus (T 2), 35 percent failed in Psoas and Lower abdomen (T 3), 45 percent failed to clear Upper back (T 4), 45 percent failed to clear Lower back (T 5), and 10 percent were unable to clear length of back and Hamstring Muscles (T 6).

## TABLE 6.

## RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM LORDOSIS

| Deformity | No. of subjects tested | Test | No. of subject failed | Percentage |
|---|---|---|---|---|
| Lordosis | 20 | T 1 Abdominal Plus | 1 | 5% |
| | | T 2 Abdominal Minus | 7 | 35% |
| | | T 3 Psoas and Lower Abdomen | 9 | 45% |
| | | T 4 Upper Back | 10 | 50% |
| | | T 5 Lower Back | 13 | 65% |
| | | T 6 Length of Back and Hamstring Muscle | 7 | 35% |

From the above Table it would be seen that only 5 percent subjects were unable to clear abdominal plus (T 1), 35 percent failed in abdominal minus (T 2), 45 percent failed to clear Psoas and Lower abdomen (T 3), 50 percent failed in Upper back (T 4), 65 percent were unable to clear Lower back (T 5) and 35 percent failed to clear length of back and Hamstring Muscles (T 6).

### Effect of Corrective Programme

For imparting corrective and conditioning training programme separate groups of 20 subjects in each deformity were selected at random except in the case of Flat-foot where only 20 subjects were found to have the defect. The training schedule prepared by the investigator was applied to all the experimental groups and training was personally supervised by the investigator with the help of Physical Education Teachers who strictly followed the instruction of the investigator. The training was carried out daily i.e. from

Monday to Saturday. Conditioning programme was given for 12 weeks to each group and progress was noted firstly at the end of 4 weeks, secondly at the end of 8 weeks, thirdly and finally at the end of 12 weeks. The details of improvement noted are given in Table 7 with regard to deformities and Table 8, 9, 10, 11 and 12 in connection with the performance of subjects in the Kraus-weber Test after the administration of conditioning programme.

**TABLE 7.**

**RESULTS OF IMPROVEMENT OF SINGLE DEFORMITIES**

| Deformity | No. of subjects | No. of No Improvement with Percentage | Slight Improvement with Percentage | Adequate Improvement with Percentage |
|---|---|---|---|---|
| Flat-foot | 20 | 19 = 95% | 1 = 5% | NIL |
| Scoliosis | 20 | 2 = 10% | 15 = 75% | 3 = 15% |
| Kyphosis | 20 | 2 = 10% | 15 = 75% | 3 = 15% |
| Lordosis | 20 | 3 = 15% | 13 = 65% | 4 = 20% |

It would be seen from this observation that there has been improvement in few cases. This ensures that there is possibility of correction of deformities by imparting corrective exercises on discussing the matters informally with the orthopeadic doctors and experts, the research scholar was given the impression that Flat-foot being a constitutional defect can not be removed except with the help of operation. However, the above chart would reveal that out of 20 subjects who were given corrective exercises for correction of Flat-foot one subject did show improvement in one of his feet after 12 weeks corrective programme. This would lead to gain an impression that Flat-foot is also correctible by exercises to some extent if not fully. However, it would require longer period of corrective

exercises in adolescents who can well receive the training and derive benefit, 95 percent showed no improvement whatsoever. It was only in the case of student (5%) slight improvement was observed.

In case scoliosis 10 percent showed no sign of any improvement, 75 percent did show slight improvement and 15 percent showed adequate improvement after the corrective programme.

As regards kyphosis it will be seen that 10 percent showed no improvement at all whereas 75 percent showed slight improvement and in the case of 15 percent subjects adequate improvement was noticed.

From the above table it would be seen in the case of lordosis 15 percent showed no signs of any improvement, 65 percent showed slight improvement and 20 percent showed adequate improvement after the corrective programme of twelve weeks.

**TABLE 8.**

**RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM FLAT-FOOT AFTER CORRECTIVE PROGRAMME**

| Deformity | No. of subjects tested | Test | No. of failures initial test | % | No. of failures after corrective program | % |
|---|---|---|---|---|---|---|
| Flat-foot | 20 | T 1 Abdominal Plus | NIL | NIL | NIL | NIL |
| | | T 2 Abdominal Minus | 5 | 25% | NIL | NIL |
| | | T 3 Psoas and Lower Abdomen | 13 | 65% | NIL | NIL |
| | | T 4 Upper Back | 1 | 5% | NIL | NIL |
| | | T 5 Lower Back | 8 | 40% | NIL | NIL |
| | | T 6 Length of Back and Hamstring Muscle | 5 | 25% | NIL | NIL |

It has been observed that before corrective programme only abdominal plus (T 1) was passed by all subjects whereas some of the subjects failed to clear rest of the items of Kraus-weber Test. But after the administration of corrective programme observation made were found postitive i.e. 100% improvement in all the items of the Kraus-weber Test were noted with regards to abdominal minus (T 2), Psoas and Lower abdomen (T 3), Upper back (T 4), and Lower back (T 5) improvement were noted 1 second to 5 seconds in holding the position. In case of length of back and Hamstring Muscles (T 6) the improvement noticed from half inch to three inches. **See Fig. 69.**

**TABLE 9.**

**RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM SCOLIOSIS AFTER CORRECTIVE PROGRAMME**

| Deformity | No. of subjects tested | Test | No. of failures initial test | % | No. of failures after corrective program | % |
|---|---|---|---|---|---|---|
| Flat-foot | 20 | T 1 Abdominal Plus | NIL | NIL | NIL | NIL |
| | | T 2 Abdominal Minus | NIL | NIL | NIL | NIL |
| | | T 3 Psoas and Lower Abdomen | 9 | 45% | NIL | NIL |
| | | T 4 Upper Back | 14 | 70% | NIL | NIL |
| | | T 5 Lower Back | 12 | 60% | NIL | NIL |
| | | T 6 Length of Back and Hamstring Muscle | 7 | 35% | NIL | NIL |

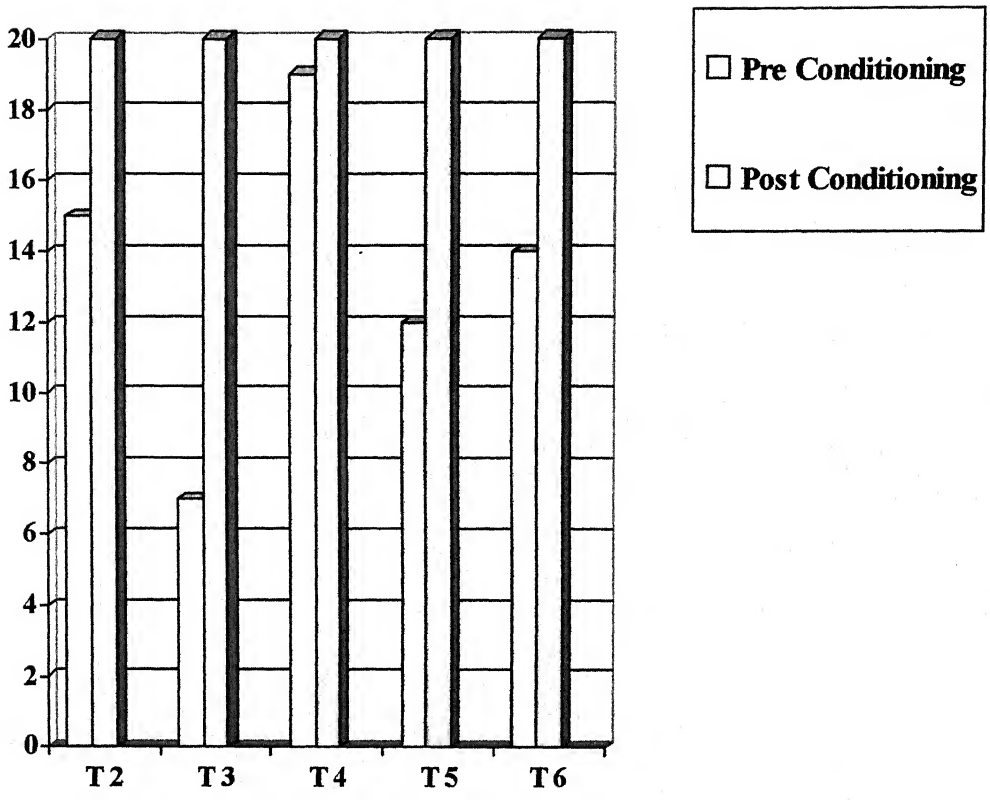


Fig.69 RESULTS OF KRAUS-WEBER TEST BEFORE AND AFTER THE ADMINISTRATION OF CONDITIONING PROGRAMME FOR SUBJECTS SUFFERING FROM FLAT-FOOT.

Note: All the subjects passed in Test 1 Before and After Training.

It is evident from the above table that all the subjects were able to clear the items of Kraus-weber Test after the conditioning programme and the subjects showed 100 percent achievement in all the items. As it was noticed that before corrective programme 45 percent were failing to clear Psoas and Lower abdomen (T 3), 70 percent were failing to clear Upper back Test (T 4), 60 percent were failing to clear Lower back Test (T 5). But these subjects showed improvement in maintaining the position after twelve weeks of training 1 second to 7 seconds. In case of length of back and Hamstring Muscles (T 6) 35 percent failed but after the period of corrective programme subjects brought improvement half inch to three inches. **See Fig. 70.**

**TABLE 10.**

**RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM KYPHOSIS AFTER CORRECTIVE PROGRAMME**

| Deformity | No. of subjects tested | Test | No. of failures initial test | % | No. of failures after corrective program | % |
|---|---|---|---|---|---|---|
| Kyphosis | 20 | T 1 Abdominal Plus | NIL | NIL | NIL | NIL |
| | | T 2 Abdominal Minus | 10 | 50% | NIL | NIL |
| | | T 3 Psoas and Lower Abdomen | 7 | 35% | NIL | NIL |
| | | T 4 Upper Back | 9 | 45% | NIL | NIL |
| | | T 5 Lower Back | 9 | 45% | NIL | NIL |
| | | T 6 Length of Back and Hamstring Muscle | 2 | 10% | NIL | NIL |

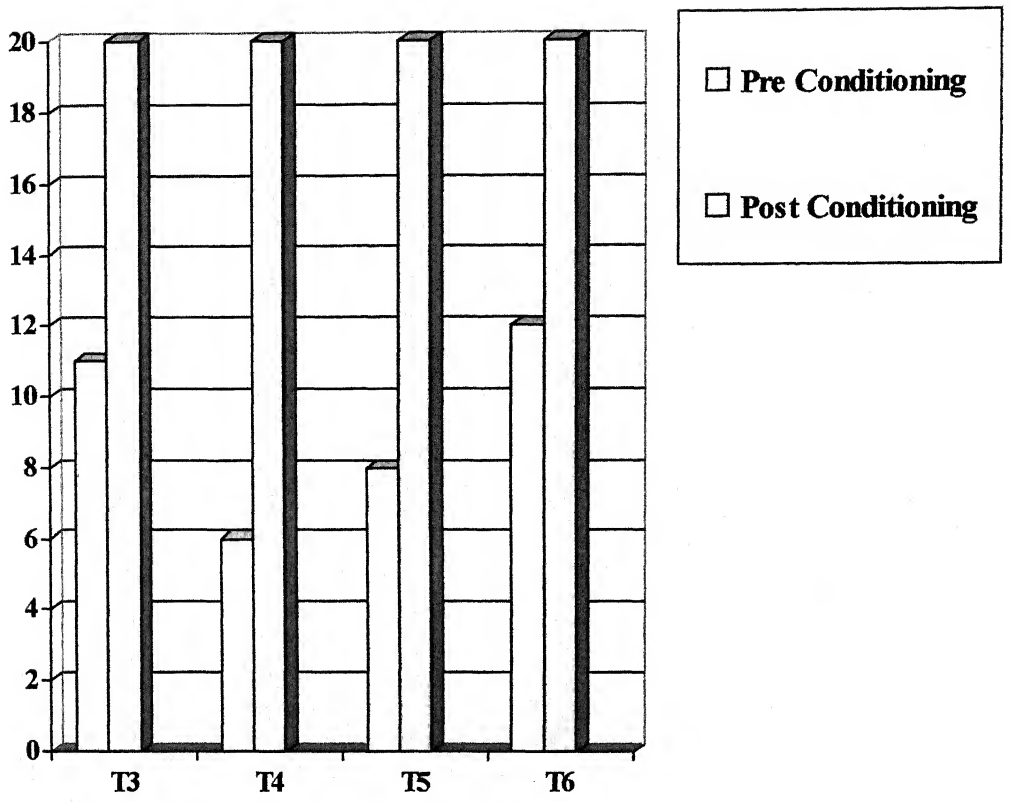


Fig.70 RESULTS OF KRAUS-WEBER TEST BEFORE AND AFTER THE ADMINISTRATION OF CONDITIONING PROGRAMME FOR SUBJECTS SUFFERING FROM SCLIOSIS.

Note: All the subjects passed in Test 1 and 2 before and after Training.

From the above table it is found that abdominal plus (T 1) was passed the subjects both the times, but those who were failing in order items of the Kraus-weber Test have shown sufficient improvement in Psoas and Lower abdomen (T 3), Upper back (T 4), and Lower back (T 5) holding the position from 1 second to 7 seconds. In length of back and Hamstring Muscles (T 6) the improvement noticed was 2 inches to 4 inches. **See Fig. 71.**

**TABLE 11.**

**RESULTS OF KRAUS-WEBER TEST OF SUBJECTS SUFFERING FROM LORDOSIS AFTER CORRECTIVE PROGRAMME**

| Deformity | No. of subjects tested | Test | No. of failures initial test | % | No. of failures after corrective program | % |
|---|---|---|---|---|---|---|
| Lordosis | 20 | T 1 Abdominal Plus | 1 | 5% | NIL | NIL |
| | | T 2 Abdominal Minus | 7 | 35% | NIL | NIL |
| | | T 3 Psoas and Lower Abdomen | 9 | 45% | NIL | NIL |
| | | T 4 Upper Back | 10 | 50% | NIL | NIL |
| | | T 5 Lower Back | 13 | 65% | NIL | NIL |
| | | T 6 Length of Back and Hamstring Muscle | 7 | 35% | 3 | 15% |

As regards to above table 5 percent were failing in Abdominal plus (T 1), 35 percent ere failing in Abdominal minus (T 2), 45 percent were failing in Psoas and Lower abdomen (T 3), 50 percent were Upper back (T 4), 65 percent in Lower back (T 5) and 35 in length of back and Hamstring Muscles (T 6) but after conditioning programme for 3 months improvement was gained by holding

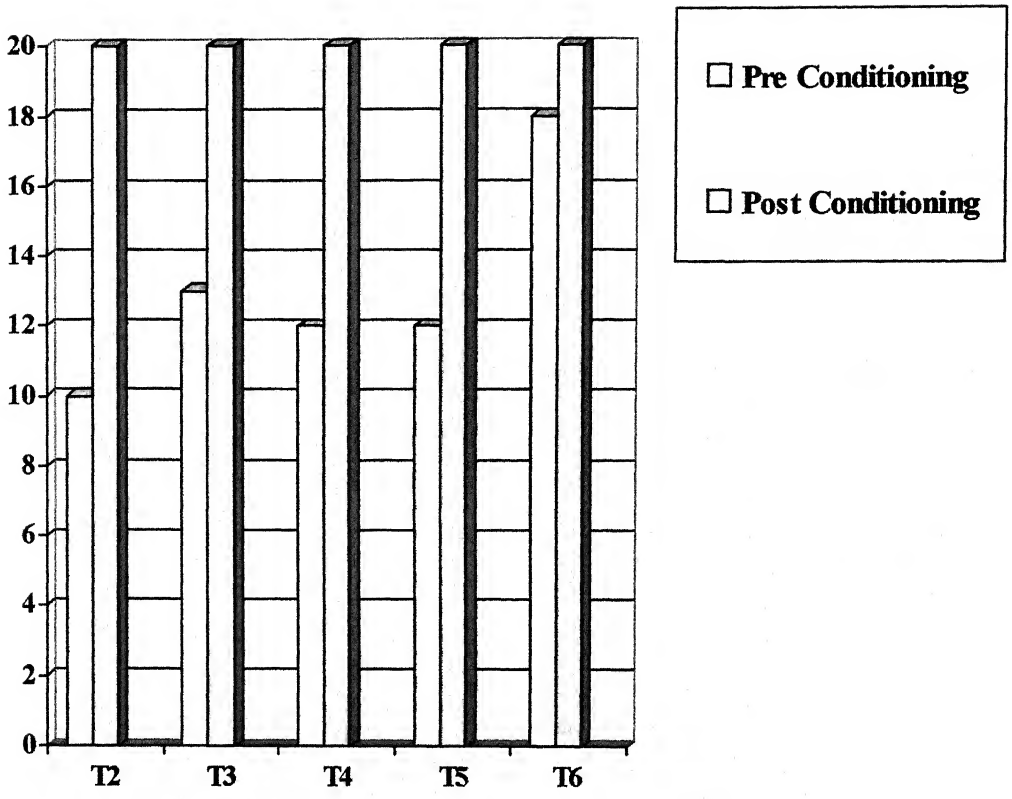


Fig.71 RESULTS OF KRAUS-WEBER TEST BEFORE AND AFTER THE ADMINISTRATION OF CONDITIONING PROGRAMME FOR SUBJECTS SUFFERING FROM KYPHOSIS.

Note: All the subjects passed in Test 1 before and after Training.

1 second to 6 seconds in Abdominal plus, Abdominal minus, Psoas and Lower Abdomen Upper back and in Lower back tests. But in length of back and Hamstring Muscles subjects showed improvement half inch to one inch. It is also noticed that 85 percent showed improvement whereas 15 percent were still failing to clear the test but it has been further observed from 15 percent failures 10% also showed half inch to one inch improvement whereas only 5 percent did not show any sign of improvement. **See Fig. 72.**

**TABLE 12.**

**THE FINAL OBSERVATION INSPECT OF CERTAIN DEFORMITIES**

| Deformity | No. of subjects | Significant Improvement | Percen-tage | Adequate Improvement | Percentage |
|---|---|---|---|---|---|
| Flat-foot | 20 | 20 | 100% | NIL | NIL |
| Scoliosis | 20 | 17 | 85% | 3 | 15% |
| Kyphosis | 20 | 17 | 85% | 3 | 15% |
| Lordosis | 20 | 16 | 80% | 4 | 20% |

It has been observed from the table that in the case of flat-foot only one subject showed very minor improvement in one of his foot otherwise there was no progress whatsoever noticed along other subjects.

In the case of other deformities the research scholar observed that the subjects have shown improvement to extend of 1mm to 3mm in the different regions on vertebrae. It has been observed that 15 percent to 20 percent subjects showed adequate improvement. It would show that three months period is not enough for bringing adequate improvement in correcting the deformities and

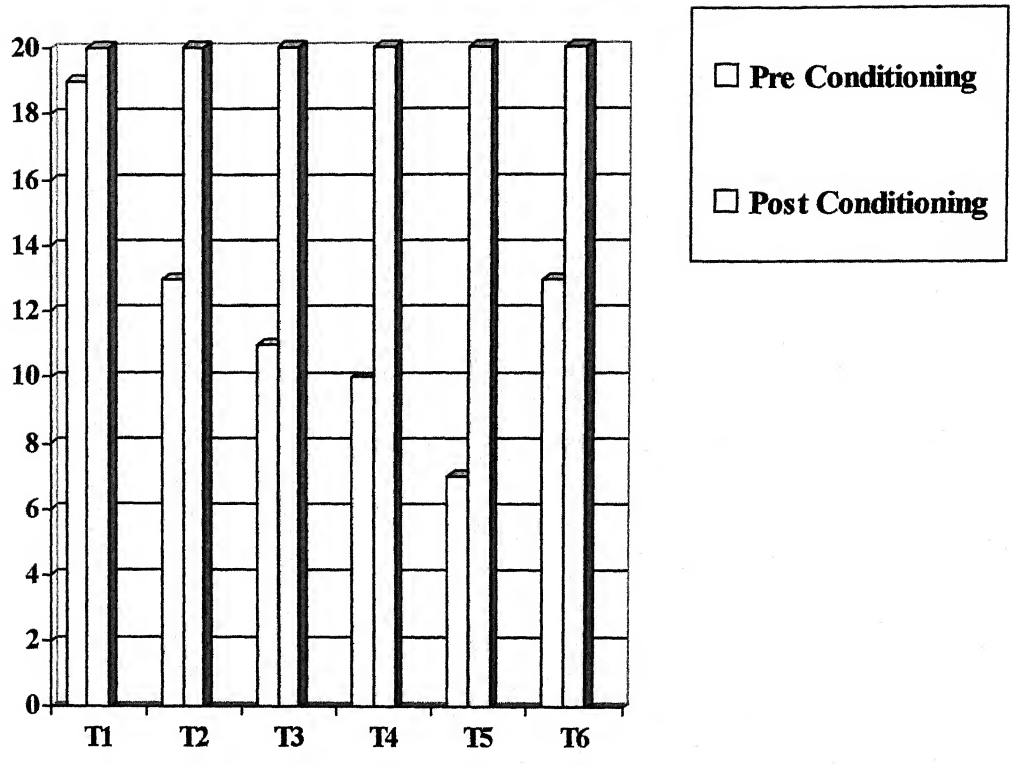


Fig.72 RESULTS OF KRAUS-WEBER TEST BEFORE AND AFTER THE ADMINISTRATION OF CONDITIONING PROGRAMME FOR SUBJECTS SUFFERING FROM LORDOSIS.

Note: All the subjects passed in Test 1 and 2 before and after Training.

perhaps longer corrective programme would be necessary for obtaining significant improvement in the corrective of these deformities among the school students.

It was observed that no subject was able to clear all the items of Kraus-weber Test before the commencement of the conditioning programme of three months duration but at the end of the correction programme it was observed that there is significant improvement in their performance and they were able to clear the Kraus-weber Test by the large.

## Discussion of Hypothesis

The hypothesis stated earlier in the study i.e. the common postural defects prevalent among boys would be Kyphosis, Lordosis and Flat-foot has been partially accepted. The hypothesis has been accepted in as much as the subjects have been found to be suffering from kyphosis, lordosis and flat-foot and rejected with regard to detection of scoliosis besides above postural defects among subjects.

The hypothesis that is lack of strength may be the main causative factor leading to postural deformities among Government Secondary School boys has been accepted.

## Discussion of Findings

The research scholar was tempted to take up this study as she observed that number of boys suffering from flat-foot, scoliosis, kyphosis and lordosis was quite visible amongst students in Government schools. It is an admitted fact that boys coming into Government schools, by and large, belong to either the poor strata of society or the lower middle class. It is rarely that boy from upper middle class step into these schools on their volition. It has been seen that such boys join the Government schools when they had been thrown out from Public Schools for poor educational performances. Compared to rich people the boys from poor strata of society do not receive any parental attention or co-operation for their well being. If they suffer from any kind of deformity no remedial measures are taken by the parents and as such the number of deformed students is on the higher side in Government schools.

The survey conducted by the scholar did reveal that number of deformed students was quite compared to the general population in the schools. It would be seen from the survey report that in a population of 1006 boys in Government schools, 324 students were found suffering from physical deformities and their percentage was more than 30%. The apparent causes for these deformities would attribute their poor living conditions as well as the neglectful attitude of the parents who being illiterate pay no attention to such defects and seek remedial treatment in time.

The society in which they live is equally responsible for nurturing bad habits. The parents are basically responsible for the growth and development of their children. It is natural that child learns from his parents and is influenced by the surroundings. Thus he would instinctively imitate and copy his elders and this would ultimately spoil his own personality because of his poor habits.

Secondly it would be admitted that good food and nutritious diet is also very essential for the development of health and the posture. It is unfortunate that living habits of the majority people being sub-standard are not conductive for better living. In India the food habits vary from place to place, community to community and the region. One can understand the impact of religion in the manners, living and food habits, dress etc. of the people. Generally the poor people and those belonging to lower strata of society are not aware of the values of the balanced and nutritious diet which is very essential for the development and adequate growth of the children.

It should be considered desirable that Government should make available nutritious food at cheaper rates for the benefit of the growing children who being the future citizens of the state need to be protected against poor growth to ensure healthy nation. Poor people can not think of or dream of providing nutritious food being themselves ignorant of its values and benefits. Unfortunately in India common people have to spend major portion of their income on food just for their existence and nutritious diet is beyond their comprehension.

In some Government schools the classrooms are not of adequate size and in addition suffer from over crowding. Moreover, proper attention is not paid for providing adequate furnished classrooms. So construction and maintenance of the school buildings should be in accordance with prescribed standard and health regulations. Adequate and well arranged lighting and seating arrangements with proper ventilation, reliable equipment for fire protection, adequate toilet and sanitation facilities and adequate facilities of drinking water are some commonly recognized requirements for a healthful school environment.

There is also paucity of teaching aids and staff. The schools thus suffer from lack of supervision and proper guidance. Lack of inclination on the part of teachers to do their best and take personal interest in their student's performances adds to the improper development of personality of the children. The scholar has also observed that in some schools students are denied their sports activities as well as physical education classes. Some schools lack sports grounds and sports equipments. In some schools it has been seen that teachers do not take interest in sports activity and the boys are allowed to play the games in their own fashion. This also does not help and encourage the students in developing their sports aptitude. If the exercises and games are not done in the correct manner they are bound to have adverse influence on child's personality. Therefore, correct guidance in sports activities and physical education is essential for all round development of a child.

It is unfortunate that even in the schools the impression is that physical education is not an important subject for study compared to the other subjects taught in schools. Infect it is the other way as "sound mind in a sound body" is must for best education and development of human personality. Therefore, it is essential that physical education should be given position of respect in the school curriculum because ultimately proper physical education will help to boost the personality of a child and remove inherent defects in him, if any, with the help of remedial corrective physical exercises. Thus the number of students suffering from flat-foot, scoliosis, kyphosis and lordosis can be reduced to a large extent which will ultimately improve the healthy image of the nation. These deformities can be corrected with the help of exercises to a large extent and the correct personality of a person can be developed.

The scholar had gained the impression that flat-foot is also correctible to some extent with the help of exercises, the other deformities e.g. scoliosis, kyphosis and lordosis are correctible to a large extent in the school itself. If proper attention is paid on the health and posture, it would have salutary affect in the out look of the child towards his growth and development. It was noticed that many of subjects were not able to clear the Kraus-weber Test at the initial stage, which clearly showed weakness of muscles, but particular set of exercises administered on these subjects for 12 weeks brought 100 percent results in enabling the subjects to clear the test. Therefore, it is quite evident that these exercises can help in improving the muscular strength of an individual and can be helpful in reducing and controlling the deformities.

The various studies under taken by the scholar to detect the correct and healthy posture of the subjects understudy, would reveal that 1.98 percent subjects suffered from flat-foot. Although the figure is not very high, but whatever it is, it can further be improved by timely corrective exercises. The motion that flat-foot is not curable without surgical operation has been exploded as the scholar was able to find that there had been slight improvement in one foot after administration of curative exercises even for a small period of 12 weeks.

In case of scoliosis 2.38 percent subjects were found suffering at the initial stage but after the corrective programme the result was noticed that 15 percent subjects showed adequate improvement, 75 percent showed slight improvement and there as no improvement in the case of 10 percent but all the subjects were able to clear all the items of Kraus-weber Test after administration of the corrective programme, which showed that there had been improvement in the muscular strength and flexibility also.

From the survey it is noted that large number of subjects suffered from kyphosis e.g. 7.45 percent. The scholar has carried the impression after seeing the subjects that this being a constitutional deformity and when any subject gains abnormal height and looks different from the class, he instinctively tries to under-play his abnormal self and thereby he unwillingly develops typical postural movements to conceal his height. After administration of corrective programme and Kraus-weber Test, it has been observed that 15 percent brought adequate improvement. 75 percent brought slight improvement and 10 percent

showed no sign of improvement. It has also been observed that after administration of the corrective programme there had been 100 percent improvement amongst the subjects to clear the Kraus-weber Test even after twelve weeks training.

As regards lordosis 4.07 percent subjects were fund suffering from this deformity in Government schools. After imparting corrective programme the progress noted was 20 percent showed adequate improvement, 65 percent showed slight improvement and 15 percent did not show any improvement. But in Kraus-weber Test 15 percent subjects were not able to clear the items relating to length of back and hamstring muscles. However 10 percent out of them able to show progress after the corrective programme.

Since these are constitutional deformities and involve proper development of bones and muscles to make a healthy and strong body; to cure these deformities requires persistent continuous training. But still the results of corrective programme are very encouraging in a small period of twelve weeks as regards the correction and removal of the deformities. If proper attention is paid at the school level these deformities can be controlled to a large extent. The health education and physical education should contain a programme of development of posture-cum-personality of the students, as these would pay an important part in developing the personality of the students who are the future of any nation. A healthy nation must possess or have healthy and strong children.

Chapter V

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

Posture is the mirror of an individual's personality. Habits play an important role in developing the personality and posture. Good posture helps the body to work better with ease. Thus good posture means pleasant habits, smiling and smart personality, which reflects confidence, courage and well disciplined attitude and behaviour. It can be said that posture is the real index of health, both physical and mental and would reflect the correct and accurate alignment of parts of the body to achieve balance in sitting, standing, walking and running. Thus we can say that habitual posture reflects the general health and the state of mind.

1006 boys were picked up from 8$^{th}$ and 9$^{th}$ classes of Lucknow Administration Secondary Schools to evaluate their posture and to detect flat-foot, scoliosis, kyphosis and lordosis commonly prevalent in school students with the help of pedograph and spondylometer. Remedial treatment was given through corrective physical exercises for 12 weeks in order to find out whether exercises were effective in removing postural deformities.

From the total 1006 students, 682 students were found having normal posture; 164 out of them suffered from multiple deformities and 160 suffered from single deformities. Amongst the 160 subjects, 20 suffered from flat-foot, 24 from scoliosis, 75 from kyphosis and the rest 41 suffered from lordosis.

These subjects were given Kraus-weber Test to clear all items of the test. These subjects were given corrective physical exercises to improve their defective posture. After administration of the corrective programme for twelve weeks again Kraus-weber Test was administered to these subjects with a view to find out whether these exercises had any corrective impact on strength and ultimately the posture. All subjects were able to clear all items of the Kraus-weber Test and improvement was noted in the Vertebrae region from 1mm to 3mm. Slight improvement was also noticed in one of the subjects suffering from foot. The results have been encouraging and the corrective exercises have proved their efficacy in correcting the postural deformities.

## Conclusions

Within the limitations of the present study, the following conclusions may be drawn:

1. The scholar had gestured that flat-foot, kyphosis and lordosis deformities were prevalent among the boys but after survey it was observed that number of students suffered not only from these deformities but from scoliosis also. The scholar also found that it was lack of strength in a child which was the main leading causative factor to postural deformities. When subjects were given corrective programme for 3 months it was observed that after conditioning programme subjects were able to pass the Kraus-weber Test and also showed flexibility and strength in different parts of the body.

1006 subjects were surveyed among them subjects of single deformities were 160 i.e. 15.90%, Multiple deformities 164 i.e. 16.30%, Normal posture 682 i.e. 67.79%. Among single deformities – Flat-foot 20 i.e. 1.98%, Scoliosis 24 i.e. 2.38%, Kyphosis 75 i.e. 7.45%, Lordosis 41 i.e. 4.07%.

2. 20 subjects were given Kraus-weber Test before and after the administration of corrective programme and following results were observed.

   In the group of flat-foot deformity 25% subjects were failing in T2 i.e. Abdominal minus, 65% in T3 i.e. Psoas and Lower Abdomen, 5% in T4 i.e. Upper Back, 40% in T5 i.e. Lower Back and 25% in T6 i.e. Back and Hamstring Muscles. After the administration of the corrective programme 100% positive results were found.

3. In the case of scoliosis T1 i.e. Abdominal Plus and T2 i.e. Abdominal Minus tests were passed by all the subjects. In T3 i.e. Psoas and Lower Abdomen 45% failed, T4 i.e. Upper Back 70% failed, T5 i.e. Lower Back 60% and T6 Length of Back and Hamstring Muscles 35% failed. After corrective programme 100% performance was noticed.

4. As regards kyphotic subjects, 100% results were found after administration of the corrective programme. However, before the administration of the corrective programme the performance was T1 i.e. Abdominal Plus all passed, T2 i.e. Abdominal Minus 50% failed, T3 i.e.

Psoas and Lower Abdomen 35% failed, T4 i.e. Upper Back and T5 i.e. Lower Back 45% failed and T6 Length of Back and Hamstring Muscles 10% failed.

5. From lordosis group initial and the post corrective programme performance were noted as under:

   5% failed in T1 i.e. Abdominal Plus, 35% failed in T2 i.e. Abdominal Minus 45% failed in T3 i.e. Psoas and Lower Back, 50% failed, T4 i.e. Upper Back 65% failed in T5 i.e. Lower Back test but after corrective programme 100% achievement was found in these tests. In case of test T6 Length of Back and Hamstring Muscles 35% failed in initial test and after corrective programme 15% cleared the test.

6. After the administration of corrective programme to 20 subjects of different deformities, the following observations are made: Flat-foot out of 20 subjects 95% made no improvement, 5% made slight improvement. Scoliosis out of 20 subjects 10% showed no improvement, 75% slight improvement and 15% showed adequate improvement.

   In case of kyphosis 10% showed no improvement, 75% slight improvement and 15% made adequate improvement after corrective programme.

   As regards lordosis 15% showed no sign of any improvement, 65% slight improvement and 20% made adequate improvement.

## Recommendations

1. The study should be done of the boys of primary section, because early detection at ealy stage needs less effort for the corrective of deformities as at this stage the children start developing certain habits.

2. This study should be made to cover the college students because at this stage the students tend to develop particular habits, which have specific influence on their posture and get up. With the help of this study their deformities can be detected in time, checked and removed to certain extent.

3. This study shall also be useful for the girls at primary, secondary and college levels for the following reasons:
   (a) Through this study girls students can be benefited in developing good and flexible posture, as this study would be useful in developing charming and graceful movements of the study.
   (b) The study would be helpful for the participation in beauty contests so covered by girls.

4. This study would be useful for the sportsman and players of either sex for the development of good posture for better performance in their fields of games and sports.

5. Since most of the children in government schools come from low strata of society and lower middle class, and their parents being ignorant of nutritious foods, cannot be expected to provide as well as afford nutritious diets which are so essential for the adequate growth of children. Providing nutritious food for children at school level at concessional rates appears essential and should merit consideration by the authorities.

6. Parents must pay attention to inculcate good habits amongst the children.

7. Teachers should take personal interest in the development of child's personality and also give correct guidance to the children to develop good habits.

8. Teachers must keep an eye on the growth and development of children and initiate timely necessary remedial actions.

9. School should have proper classrooms with enough light and proper sized furniture.

10. Schools should have enough play grounds wit proper sports facilities.

11. There should be compulsory annual medical check-up.

12. Physical Education and Health Education classes should be held regularly and stress should be given for development of good habits so essential for good posture.

13. Corrective exercises can be conducted during the physical and health education periods.

14. Children should be encouraged to play games, which play an important part in improving health, and broad mindedness which is very essential for the development of amiable and pleasing personality of an individual. This will ensure healthy and disciplined nation.

# APPENDICES

# APPENDIX - A

## MEASUREMENTS OF SUBJECTS FOR IDENTIFICATION OF POSTURAL DEFECTS

| Code | Height (cms.) | Cerbical (cms.) | Thoracic (cms.) | | | | Lumber (cms.) | Flat-Foot |
|---|---|---|---|---|---|---|---|---|
| | | | Upper | Middle | Lower | Total | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 01 | 143 | 8.5 | 5.0 | 5.4 | 7.5 | 17.9 | 4.5 | Normal |
| 02 | 132 | 5.5 | 2.6 | 3.9 | 4.1 | 10.6 | 2.0 | Normal |
| 03 | 139 | 7.0 | 5.5 | 8.0 | 10.0 | 23.5 | 7.3 | Normal |
| 04 | 141 | 7.2 | 5.1 | 5.4 | 7.7 | 18.2 | 5.3 | Normal |
| 05 | 149 | 4.8 | 3.7 | 4.0 | 7.0 | 14.7 | 5.7 | Normal |
| 06 | 153 | 4.5 | 1.0 | 2.0 | 4.0 | 7.0 | 3.0 | Normal |
| 07 | 154 | 11.0 | 5.7 | 5.4 | 7.3 | 18.4 | 5.7 | Normal |
| 08 | 139 | 8.4 | 6.0 | 7.0 | 6.5 | 19.5 | 2.0 | Normal |
| 09 | 149 | 4.9 | 3.4 | 3.5 | 5.0 | 13.9 | 2.0 | Normal |
| 10 | 142 | 4.6 | 2.0 | 3.2 | 6.7 | 11.9 | 5.3 | Normal |
| 11 | 155 | 6.9 | 4.8 | 4.3 | 5.8 | 14.9 | 6.1 | Normal |
| 12 | 158 | 7.7 | 4.6 | 4.0 | 5.0 | 13.6 | 6.1 | Normal |
| 13 | 146 | 3.3 | 3.4 | 4.6 | 5.7 | 13.7 | 3.0 | Normal |
| 14 | 144 | 5.0 | 3.1 | 4.5 | 7.6 | 15.2 | 4.9 | Normal |
| 15 | 145 | 5.1 | 3.2 | 4.4 | 6.6 | 14.2 | 4.1 | Normal |
| 16 | 145 | 8.0 | 5.2 | 4.9 | 7.0 | 17.1 | 4.4 | Normal |
| 17 | 144 | 6.3 | 3.5 | 3.9 | 5.9 | 13.3 | 3.0 | Normal |
| 18 | 158 | 7.4 | 4.0 | 4.4 | 5.5 | 13.9 | 7.0 | Normal |
| 19 | 134 | 8.2 | 6.5 | 7.1 | 7.1 | 20.7 | 7.0 | Normal |
| 20 | 146 | 7.5 | 5.8 | 6.5 | 8.6 | 20.9 | 8.8 | Normal |
| 21 | 141 | 3.9 | 6.0 | 6.4 | 10.5 | 22.9 | 6.8 | Normal |
| 22 | 147 | 6.3 | 3.0 | 2.0 | 4.2 | 9.2 | 4.0 | Normal |
| 23 | 148 | 6.0 | 4.5 | 4.7 | 6.5 | 15.7 | 6.0 | Normal |
| 24 | 139 | 7.9 | 5.4 | 5.0 | 8.0 | 18.4 | 6.5 | Normal |
| 25 | 162 | 4.5 | 1.6 | 2.5 | 6.5 | 10.6 | 5.6 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 26 | 140 | 7.5 | 3.2 | 2.7 | 5.7 | 11.6 | 6.6 | Normal |
| 27 | 140 | 8.3 | 5.0 | 3.6 | 5.0 | 13.6 | 4.6 | Normal |
| 28 | 144 | 6.2 | 4.4 | 3.8 | 5.4 | 13.6 | 7.9 | Both Flat |
| 29 | 145 | 6.2 | 4.4 | 3.9 | 5.1 | 13.4 | 5.0 | Normal |
| 30 | 157 | 8.0 | 3.6 | 4.4 | 7.1 | 15.1 | 6.6 | Normal |
| 31 | 136 | 7.0 | 3.8 | 5.3 | 6.7 | 15.8 | 3.6 | Normal |
| 32 | 135 | 6.4 | 3.9 | 5.3 | 8.0 | 17.2 | 4.5 | Normal |
| 33 | 136 | 8.0 | 5.9 | 7.0 | 10.5 | 23.4 | 7.0 | Normal |
| 34 | 160 | 6.5 | 3.3 | 2.7 | 4.0 | 10.0 | 4.9 | Normal |
| 35 | 156.5 | 4.0 | 2.5 | 4.6 | 7.5 | 14.5 | 3.9 | Normal |
| 36 | 146 | 5.6 | 3.8 | 4.0 | 5.9 | 13.7 | 3.0 | Normal |
| 37 | 150 | 3.9 | 3.6 | 3.9 | 4.1 | 11.6 | 3.3 | Normal |
| 38 | 156 | 5.3 | 1.2 | 1.0 | 3.4 | 5.6 | 5.0 | Normal |
| 39 | 155 | 5.3 | 3.2 | 3.5 | 3.9 | 10.6 | 5.0 | Normal |
| 40 | 162 | 6.8 | 3.4 | 2.5 | 3.6 | 9.5 | 5.0 | Normal |
| 41 | 160 | 6.6 | 3.5 | 3.9 | 4.1 | 11.5 | 3.5 | Normal |
| 42 | 162 | 6.7 | 3.4 | 3.5 | 3.9 | 10.8 | 5.1 | Normal |
| 43 | 160 | 4.0 | 1.2 | 1.0 | 3.9 | 6.1 | 3.4 | Normal |
| 44 | 146 | 4.0 | 0.7 | 2.0 | 5.3 | 8.0 | 3.7 | Normal |
| 45 | 150 | 4.1 | 3.5 | 3.8 | 5.1 | 12.4 | 4.5 | Normal |
| 46 | 148 | 4.1 | 3.7 | 3.9 | 5.5 | 13.1 | 4.1 | Normal |
| 47 | 156 | 3.5 | 3.5 | 3.7 | 4.1 | 11.3 | 3.3 | Normal |
| 48 | 156 | 3.0 | 1.0 | 0.7 | 2.4 | 4.1 | 2.9 | Normal |
| 49 | 166 | 5.0 | 1.4 | 1.4 | 3.4 | 6.2 | 6.3 | Normal |
| 50 | 150 | 5.3 | 1.5 | 1.5 | 3.5 | 6.5 | 2.3 | 'L' |
| 51 | 153 | 4.1 | 1.6 | 2.8 | 5.2 | 9.6 | 3.5 | Normal |
| 52 | 133 | 6.3 | 4.4 | 4.8 | 6.3 | 15.5 | 3.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 53 | 136 | 6.5 | 3.3 | 3.0 | 5.7 | 12.0 | 4.9 | Normal |
| 54 | 139 | 2.5 | 0.8 | 2.5 | 5.0 | 8.3 | 2.5 | Normal |
| 55 | 145.5 | 3.8 | 0.5 | 1.4 | 5.0 | 5.9 | 1.9 | Normal |
| 56 | 140 | 3.5 | 2.7 | 4.3 | 8.0 | 15.0 | 6.5 | Normal |
| 57 | 155 | 4.3 | 3.9 | 3.9 | 5.2 | 13.0 | 3.5 | Normal |
| 58 | 150 | 5.3 | 2.5 | 2.9 | 3.9 | 9.3 | 3.1 | Normal |
| 59 | 134 | 4.0 | 2.7 | 5.5 | 5.5 | 13.7 | 1.9 | Normal |
| 60 | 147 | 3.8 | 1.0 | 3.1 | 6.0 | 10.1 | 2.5 | Normal |
| 61 | 148 | 4.4 | 2.4 | 1.9 | 3.4 | 7.7 | 2.0 | Normal |
| 62 | 149 | 4.8 | 1.3 | 1.8 | 3.2 | 6.3 | 2.2 | Normal |
| 63 | 148 | 3.4 | 0.3 | 0.9 | 3.9 | 5.1 | 3.0 | Normal |
| 64 | 146 | 4.6 | 2.6 | 4.1 | 6.3 | 13.0 | 2.5 | Normal |
| 65 | 147 | 5.6 | 5.0 | 5.1 | 5.2 | 15.3 | 3.9 | Normal |
| 66 | 147 | 4.8 | 3.4 | 6.0 | 8.5 | 17.9 | 4.5 | Normal |
| 67 | 150 | 3.9 | 0.8 | 1.7 | 6.1 | 8.6 | 4.4 | Normal |
| 68 | 131 | 3.2 | 0.9 | 2.5 | 6.5 | 9.9 | 3.9 | Normal |
| 69 | 159 | 4.9 | 1.5 | 2.4 | 4.7 | 8.6 | 3.2 | Normal |
| 70 | 151 | 5.2 | 2.6 | 2.0 | 5.4 | 10.0 | 4.9 | Normal |
| 71 | 154 | 5.3 | 2.4 | 3.4 | 5.0 | 10.8 | 2.5 | Normal |
| 72 | 138 | 5.4 | 3.0 | 3.5 | 5.0 | 11.5 | 2.3 | Normal |
| 73 | 137 | 8.0 | 4.2 | 4.0 | 2.9 | 11.1 | 0.5 | Normal |
| 74 | 148 | 5.0 | 2.7 | 3.8 | 5.5 | 12.0 | 3.8 | Normal |
| 75 | 146 | 6.5 | 3.5 | 5.0 | 7.5 | 16.0 | 3.5 | Normal |
| 76 | 142 | 4.4 | 1.7 | 2.5 | 4.2 | 8.4 | 2.0 | Normal |
| 77 | 150 | 4.0 | 1.9 | 2.2 | 4.5 | 8.6 | 5.7 | Normal |
| 78 | 146 | 4.8 | 2.2 | 4.3 | 6.5 | 13.0 | 2.0 | Normal |
| 79 | 148 | 6.5 | 3.8 | 4.4 | 6.0 | 14.2 | 3.0 | Normal |
| 80 | 158 | 5.8 | 2.5 | 4.0 | 2.4 | 8.9 | 2.4 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 81 | 150 | 5.8 | 2.8 | 3.5 | 6.0 | 12.3 | 4.0 | Normal |
| 82 | 158 | 5.7 | 3.5 | 4.1 | 3.5 | 11.1 | 3.6 | Normal |
| 83 | 138 | 5.0 | 2.6 | 3.0 | 5.0 | 10.6 | 3.1 | Normal |
| 84 | 150 | 5.5 | 3.9 | 4.1 | 6.0 | 14.0 | 5.5 | Normal |
| 85 | 145 | 5.0 | 3.2 | 5.0 | 7.0 | 15.2 | 2.5 | Normal |
| 86 | 144 | 5.1 | 3.2 | 3.9 | 6.5 | 13.6 | 3.5 | Normal |
| 87 | 143 | 5.1 | 3.4 | 5.2 | 6.6 | 15.2 | 3.2 | Normal |
| 88 | 145 | 5.5 | 2.5 | 3.0 | 5.5 | 11.0 | 4.9 | Normal |
| 89 | 132 | 5.5 | 1.4 | 1.7 | 2.7 | 5.8 | 0.5 | Normal |
| 90 | 152 | 5.5 | 4.0 | 6.4 | 8.0 | 18.4 | 5.5 | Normal |
| 91 | 135 | 5.4 | 3.9 | 3.9 | 5.1 | 12.9 | 3.5 | Normal |
| 92 | 134 | 5.5 | 4.1 | 3.5 | 5.5 | 13.1 | 4.1 | Normal |
| 93 | 135 | 5.2 | 3.5 | 4.1 | 4.5 | 12.1 | 5.0 | Normal |
| 94 | 140 | 5.6 | 4.1 | 4.8 | 7.9 | 16.8 | 3.5 | Normal |
| 95 | 150 | 6.6 | 3.5 | 3.7 | 5.2 | 12.4 | 3.4 | Normal |
| 96 | 136 | 5.5 | 2.7 | 2.2 | 4.0 | 8.9 | 2.0 | Normal |
| 97 | 155 | 6.6 | 4.0 | 3.2 | 4.7 | 11.9 | 4.0 | Normal |
| 98 | 150 | 5.9 | 3.2 | 3.6 | 5.1 | 11.9 | 4.1 | Normal |
| 99 | 150 | 5.8 | 3.4 | 3.8 | 5.7 | 12.9 | 2.5 | Normal |
| 100 | 136 | 5.6 | 4.1 | 4.5 | 6.5 | 15.1 | 2.5 | Normal |
| 101 | 135 | 6.2 | 6.0 | 7.0 | 9.5 | 22.5 | 5.0 | Normal |
| 102 | 135 | 5.0 | 3.0 | 4.0 | 4.0 | 11.0 | 5.0 | Normal |
| 103 | 140 | 6.0 | 1.4 | 0.5 | 2.0 | 3.9 | 0.5 | Normal |
| 104 | 145 | 6.4 | 3.3 | 3.5 | 4.5 | 11.3 | 2.5 | Normal |
| 105 | 150 | 4.0 | 1.7 | 3.9 | 7.2 | 12.8 | 3.9 | Normal |
| 106 | 154 | 5.3 | 1.4 | 1.9 | 5.5 | 8.8 | 2.3 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 107 | 137 | 3.0 | 1.5 | 3.5 | 6.5 | 11.5 | 1.0 | Normal |
| 108 | 145 | 5.5 | 3.1 | 3.5 | 3.9 | 10.5 | 5.1 | Normal |
| 109 | 147 | 4.9 | 3.4 | 3.5 | 5.0 | 11.9 | 3.5 | Normal |
| 110 | 143 | 5.0 | 3.2 | 4.9 | 6.5 | 14.6 | 3.0 | Normal |
| 111 | 151 | 5.3 | 2.5 | 3.5 | 5.1 | 11.1 | 3.5 | Normal |
| 112 | 146 | 6.5 | 3.3 | 1.5 | 4.2 | 9.0 | 2.0 | Normal |
| 113 | 164 | 7.5 | 3.5 | 2.5 | 3.9 | 9.9 | 4.9 | Normal |
| 114 | 154 | 6.3 | 4.5 | 5.5 | 7.0 | 17.0 | 1.1 | Normal |
| 115 | 154 | 5.1 | 1.4 | 2.8 | 5.9 | 10.1 | 3.0 | Normal |
| 116 | 147 | 6.0 | 1.9 | 0.8 | 3.0 | 5.7 | 3.5 | Normal |
| 117 | 135 | 5.4 | 2.5 | 5.1 | 5.9 | 13.5 | 4.5 | Normal |
| 118 | 142 | 6.0 | 4.0 | 4.3 | 5.9 | 14.2 | 1.5 | Normal |
| 119 | 140 | 5.6 | 4.0 | 4.9 | 8.0 | 16.9 | 3.3 | Both Flat |
| 120 | 149 | 4.5 | 5.0 | 6.9 | 7.0 | 18.9 | 1.6 | Normal |
| 121 | 144 | 5.2 | 1.9 | 2.1 | 3.5 | 7.5 | 1.0 | Normal |
| 122 | 135 | 6.3 | 4.5 | 4.9 | 6.1 | 15.5 | 3.5 | Normal |
| 123 | 155 | 7.0 | 3.4 | 3.6 | 6.2 | 13.2 | 2.8 | Normal |
| 124 | 141 | 6.5 | 3.4 | 3.7 | 5.0 | 12.1 | 3.0 | Normal |
| 125 | 135 | 5.3 | 1.8 | 2.1 | 4.5 | 8.4 | 1.0 | Normal |
| 126 | 151 | 5.1 | 3.5 | 4.5 | 5.1 | 13.1 | 2.6 | Normal |
| 127 | 157 | 6.5 | 3.5 | 1.8 | 3.4 | 8.7 | 5.8 | Normal |
| 128 | 146 | 3.6 | 1.0 | 0.9 | 2.8 | 4.7 | 2.5 | Normal |
| 129 | 157 | 6.1 | 3.6 | 2.9 | 3.5 | 10.0 | 5.8 | Normal |
| 130 | 151 | 5.3 | 2.0 | 3.5 | 5.9 | 11.4 | 2.3 | Normal |
| 131 | 150 | 4.5 | 2.4 | 2.6 | 4.3 | 9.3 | 3.4 | Normal |
| 132 | 154 | 4.0 | 2.5 | 3.0 | 4.2 | 9.7 | 3.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 133 | 158 | 4.4 | 1.5 | 0.4 | 3.0 | 4.9 | 4.4 | Normal |
| 134 | 142 | 3.2 | 0.5 | 0.9 | 3.5 | 4.9 | 2.5 | Normal |
| 135 | 143 | 5.7 | 4.9 | 4.6 | 5.7 | 15.2 | 5.7 | Normal |
| 136 | 145 | 5.6 | 4.7 | 4.5 | 5.5 | 14.7 | 5.5 | Normal |
| 137 | 142 | 5.7 | 3.0 | 2.9 | 3.8 | 9.7 | 1.0 | Normal |
| 138 | 154 | 4.5 | 1.2 | 2.1 | 4.5 | 7.8 | 4.0 | Normal |
| 139 | 173 | 8.9 | 3.0 | 3.5 | 4.5 | 11.0 | 6.1 | Normal |
| 140 | 170 | 7.1 | 3.1 | 3.9 | 4.8 | 11.8 | 6.5 | Normal |
| 141 | 170 | 4.3 | 1.1 | 1.0 | 3.5 | 5.6 | 4.9 | Normal |
| 142 | 156 | 5.7 | 3.5 | 3.1 | 5.9 | 12.5 | 5.7 | Normal |
| 143 | 166 | 6.5 | 4.3 | 3.1 | 3.9 | 11.3 | 4.5 | Normal |
| 144 | 172 | 6.9 | 5.7 | 5.4 | 5.1 | 16.2 | 6.1 | Normal |
| 145 | 164 | 3.9 | 1.2 | 2.5 | 5.4 | 9.1 | 4.5 | Normal |
| 146 | 141 | 6.4 | 2.5 | 3.1 | 4.5 | 10.1 | 3.3 | Normal |
| 147 | 176 | 4.9 | 0.2 | 0.5 | 2.0 | 2.7 | 4.5 | Normal |
| 148 | 157 | 4.9 | 3.1 | 3.7 | 5.1 | 11.9 | 4.1 | Normal |
| 149 | 157 | 5.5 | 2.3 | 2.3 | 5.8 | 10.4 | 6.5 | Both Flat |
| 150 | 158 | 5.5 | 3.2 | 3.9 | 5.5 | 12.6 | 3.9 | Normal |
| 151 | 158 | 5.0 | 2.5 | 2.5 | 4.0 | 9.0 | 3.5 | Normal |
| 152 | 158 | 5.3 | 3.2 | 3.5 | 5.0 | 11.7 | 3.9 | Normal |
| 153 | 174 | 6.6 | 3.5 | 3.5 | 2.5 | 9.5 | 4.9 | Both Flat |
| 154 | 174 | 8.0 | 5.0 | 4.0 | 4.5 | 13.5 | 6.0 | Normal |
| 155 | 156 | 5.9 | 2.5 | 3.9 | 3.5 | 9.9 | 3.5 | Normal |
| 156 | 169 | 6.3 | 2.5 | 3.0 | 5.5 | 11.0 | 5.9 | Normal |
| 157 | 156 | 5.5 | 3.3 | 2.7 | 4.0 | 10.0 | 4.9 | Normal |
| 158 | 159 | 5.6 | 1.0 | 0.7 | 2.5 | 4.2 | 3.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 159 | 155 | 5.5 | 2.2 | 0.9 | 3.5 | 6.6 | 3.9 | Normal |
| 160 | 160 | 5.9 | 3.5 | 3.0 | 3.9 | 10.4 | 4.4 | Normal |
| 161 | 159 | 5.3 | 3.5 | 4.1 | 5.2 | 12.8 | 5.7 | Normal |
| 162 | 168 | 4.1 | 4.1 | 3.9 | 3.7 | 11.7 | 5.0 | Normal |
| 163 | 169 | 4.1 | 4.0 | 3.3 | 3.8 | 11.1 | 4.7 | Normal |
| 164 | 173 | 7.5 | 3.1 | 3.1 | 2.5 | 8.7 | 5.0 | Normal |
| 165 | 159 | 5.0 | 3.6 | 3.5 | 5.5 | 12.6 | 4.5 | Normal |
| 166 | 167 | 6.3 | 4.3 | 3.0 | 4.1 | 11.4 | 4.4 | Normal |
| 167 | 157 | 8.4 | 3.5 | 3.9 | 5.5 | 12.9 | 6.0 | Normal |
| 168 | 140 | 5.7 | 2.0 | 4.0 | 5.3 | 11.3 | 3.4 | Normal |
| 169 | 162 | 6.3 | 4.6 | 4.9 | 6.3 | 15.8 | 6.5 | Normal |
| 170 | 168 | 8.5 | 2.8 | 3.1 | 5.6 | 11.5 | 5.2 | Normal |
| 171 | 164 | 4.9 | 3.4 | 3.2 | 5.5 | 12.1 | 5.5 | Normal |
| 172 | 158 | 9.3 | 3.5 | 3.5 | 6.1 | 13.1 | 4.5 | Normal |
| 173 | 157 | 4.5 | 2.5 | 2.1 | 4.5 | 9.1 | 7.0 | Normal |
| 174 | 164 | 3.5 | 1.0 | 0.5 | 2.7 | 4.2 | 3.7 | Normal |
| 175 | 170 | 6.0 | 1.0 | 1.0 | 2.5 | 4.5 | 6.4 | Both Flat |
| 176 | 180 | 5.2 | 3.3 | 2.5 | 4.1 | 9.9 | 4.5 | Normal |
| 177 | 173 | 7.2 | 5.2 | 5.3 | 5.1 | 15.6 | 6.0 | Normal |
| 178 | 164 | 4.5 | 1.2 | 2.6 | 5.5 | 9.3 | 5.0 | Both Flat |
| 179 | 140 | 4.9 | 0.5 | 1.5 | 3.9 | 5.9 | 2.5 | Normal |
| 180 | 154 | 5.2 | 4.0 | 4.2 | 6.5 | 14.7 | 5.3 | Normal |
| 181 | 166 | 6.3 | 3.2 | 3.5 | 6.5 | 13.2 | 7.2 | Normal |
| 182 | 166 | 6.5 | 4.3 | 3.0 | 3.9 | 11.2 | 4.5 | Normal |
| 183 | 156 | 4.5 | 1.2 | 2.2 | 4.9 | 8.3 | 3.8 | Normal |
| 184 | 151 | 4.5 | 3.2 | 3.8 | 5.5 | 12.5 | 2.8 | Normal |
| 185 | 160 | 6.5 | 3.9 | 3.9 | 7.5 | 15.3 | 8.4 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 186 | 163 | 7.8 | 3.8 | 2.5 | 3.9 | 10.2 | 5.2 | Normal |
| 187 | 141 | 5.2 | 3.4 | 3.7 | 5.0 | 12.1 | 2.9 | Normal |
| 188 | 156 | 7.5 | 3.9 | 3.9 | 7.5 | 15.3 | 6.2 | Normal |
| 189 | 156 | 4.8 | 5.0 | 4.4 | 5.1 | 14.5 | 3.5 | Normal |
| 190 | 180 | 5.2 | 2.5 | 2.0 | 3.8 | 8.3 | 4.7 | Normal |
| 191 | 140 | 5.8 | 3.1 | 3.9 | 6.1 | 13.1 | 4.3 | Normal |
| 192 | 158 | 6.5 | 3.5 | 2.9 | 3.5 | 9.9 | 4.4 | Normal |
| 193 | 145 | 5.5 | 4.9 | 4.6 | 5.5 | 15.0 | 5.7 | Normal |
| 194 | 172 | 7.3 | 5.7 | 5.4 | 5.0 | 16.1 | 6.2 | Normal |
| 195 | 167 | 4.5 | 1.3 | 2.1 | 4.5 | 7.9 | 5.5 | Normal |
| 196 | 162 | 6.0 | 3.2 | 2.9 | 4.0 | 10.1 | 5.1 | Normal |
| 197 | 166 | 6.6 | 3.0 | 1.4 | 2.8 | 7.2 | 5.5 | Normal |
| 198 | 158 | 5.5 | 1.9 | 1.8 | 3.4 | 7.1 | 4.5 | Normal |
| 199 | 155 | 5.5 | 3.1 | 4.1 | 5.5 | 12.7 | 3.6 | Normal |
| 200 | 171 | 7.2 | 3.3 | 2.5 | 3.8 | 9.6 | 4.7 | Normal |
| 201 | 161 | 6.3 | 4.5 | 4.7 | 6.0 | 15.2 | 6.5 | Normal |
| 202 | 145 | 6.1 | 3.8 | 4.1 | 6.7 | 14.6 | 4.5 | Normal |
| 203 | 143 | 4.4 | 1.7 | 2.5 | 4.1 | 8.3 | 3.5 | Normal |
| 204 | 161 | 3.8 | 1.3 | 2.5 | 5.5 | 9.3 | 4.0 | Normal |
| 205 | 165 | 5.0 | 0.8 | 2.1 | 3.5 | 6.4 | 5.0 | Normal |
| 206 | 135 | 5.2 | 4.1 | 4.5 | 6.1 | 14.7 | 3.1 | Normal |
| 207 | 134 | 6.2 | 6.0 | 6.9 | 8.5 | 20.4 | 4.5 | Normal |
| 208 | 173 | 6.5 | 3.3 | 1.5 | 2.5 | 7.3 | 4.5 | Normal |
| 209 | 167.5 | 5.0 | 0.8 | 2.1 | 3.4 | 6.3 | 5.0 | Normal |
| 210 | 161.5 | 4.2 | 1.3 | 2.5 | 5.5 | 9.3 | 4.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 211 | 157 | 6.0 | 1.5 | 0.5 | 1.8 | 3.8 | 3.5 | Normal |
| 212 | 154 | 5.0 | 2.5 | 3.0 | 5.0 | 10.5 | 5.5 | Normal |
| 213 | 164 | 3.5 | 1.0 | 0.5 | 3.7 | 5.2 | 4.7 | Normal |
| 214 | 160.5 | 6.1 | 2.3 | 3.3 | 5.8 | 11.4 | 5.7 | Normal |
| 215 | 177 | 4.5 | 0.2 | 0.5 | 2.0 | 2.7 | 4.0 | Normal |
| 216 | 169 | 7.0 | 3.0 | 2.0 | 3.7 | 8.7 | 4.5 | Normal |
| 217 | 168.5 | 6.6 | 3.0 | 1.5 | 3.5 | 8.0 | 5.5 | Normal |
| 218 | 173 | 6.5 | 4.0 | 2.5 | 3.5 | 10.0 | 5.0 | Normal |
| 219 | 171 | 7.0 | 2.7 | 0.8 | 2.0 | 5.5 | 4.5 | Normal |
| 220 | 157 | 5.5 | 3.5 | 3.7 | 5.1 | 12.3 | 4.0 | Normal |
| 221 | 154 | 8.0 | 6.2 | 5.9 | 6.9 | 19.0 | 6.9 | Normal |
| 222 | 158 | 6.0 | 2.6 | 2.2 | 3.5 | 8.3 | 5.5 | Normal |
| 223 | 135 | 5.4 | 3.5 | 4.1 | 4.3 | 11.9 | 4.9 | Normal |
| 224 | 163 | 9.6 | 7.2 | 5.6 | 6.5 | 19.3 | 7.5 | Normal |
| 225 | 166 | 6.0 | 2.1 | 1.5 | 2.6 | 6.2 | 3.5 | Normal |
| 226 | 152.5 | 8.0 | 5.4 | 5.0 | 6.2 | 16.6 | 4.5 | Normal |
| 227 | 154 | 7.9 | 6.3 | 5.5 | 6.8 | 18.6 | 6.5 | Normal |
| 228 | 163 | 7.0 | 2.4 | 2.0 | 3.0 | 7.4 | 1.5 | Normal |
| 229 | 155.5 | 8.5 | 3.9 | 3.0 | 5.0 | 11.9 | 4.0 | Normal |
| 230 | 162 | 5.1 | 6.4 | 6.6 | 8.0 | 21.0 | 7.5 | Normal |
| 231 | 156 | 5.0 | 2.2 | 3.0 | 5.5 | 10.7 | 5.7 | Normal |
| 232 | 158 | 5.3 | 2.5 | 1.4 | 2.5 | 6.4 | 3.5 | Normal |
| 233 | 155 | 5.5 | 1.2 | 2.2 | 4.5 | 8.9 | 4.0 | Normal |
| 234 | 172 | 7.5 | 3.0 | 3.5 | 4.5 | 11.0 | 6.0 | Normal |
| 235 | 170 | 7.0 | 3.5 | 3.9 | 4.6 | 12.0 | 6.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 236 | 172 | 5.3 | 1.0 | 1.0 | 3.5 | 5.5 | 5.0 | Normal |
| 237 | 157 | 5.7 | 3.5 | 3.2 | 5.6 | 12.3 | 5.7 | Normal |
| 238 | 167 | 6.2 | 4.3 | 3.5 | 3.9 | 11.7 | 4.5 | Normal |
| 239 | 172 | 6.5 | 5.6 | 5.4 | 5.2 | 16.2 | 6.5 | Normal |
| 240 | 165 | 4.5 | 1.2 | 2.5 | 5.5 | 9.2 | 5.0 | Normal |
| 241 | 149 | 6.4 | 2.5 | 3.0 | 4.5 | 10.0 | 3.5 | Normal |
| 242 | 177 | 5.1 | 0.2 | 0.5 | 2.5 | 3.2 | 4.5 | Normal |
| 243 | 158 | 5.0 | 3.2 | 3.7 | 5.2 | 12.1 | 4.5 | Normal |
| 244 | 156 | 5.5 | 2.3 | 2.3 | 5.6 | 10.2 | 6.1 | Normal |
| 245 | 158 | 5.5 | 3.2 | 3.9 | 5.5 | 12.6 | 4.1 | Normal |
| 246 | 165 | 5.3 | 3.2 | 3.5 | 5.0 | 11.7 | 4.0 | Normal |
| 247 | 175 | 6.5 | 3.5 | 3.5 | 2.5 | 9.5 | 5.2 | Normal |
| 248 | 156 | 5.9 | 2.5 | 3.5 | 3.5 | 11.5 | 4.5 | Normal |
| 249 | 170 | 6.5 | 2.5 | 3.0 | 5.5 | 11.0 | 6.0 | Normal |
| 250 | 156 | 5.5 | 3.5 | 3.0 | 4.0 | 10.5 | 5.0 | Normal |
| 251 | 160 | 5.6 | 1.0 | 0.5 | 2.5 | 4.0 | 3.5 | Normal |
| 252 | 160 | 5.5 | 2.3 | 0.9 | 3.5 | 6.7 | 4.1 | Normal |
| 253 | 155 | 5.0 | 2.9 | 3.1 | 5.0 | 11.0 | 4.5 | Normal |
| 254 | 173 | 7.1 | 5.1 | 4.3 | 4.5 | 13.9 | 6.3 | Normal |
| 255 | 169 | 4.2 | 4.0 | 3.2 | 3.9 | 11.1 | 4.5 | Normal |
| 256 | 167 | 4.5 | 3.5 | 3.3 | 5.5 | 12.3 | 5.5 | Normal |
| 257 | 154 | 5.5 | 2.8 | 2.6 | 4.2 | 9.6 | 3.7 | Normal |
| 258 | 169 | 5.1 | 1.7 | 1.9 | 4.5 | 8.1 | 5.3 | Normal |
| 259 | 167.5 | 5.5 | 1.6 | 1.4 | 3.1 | 6.1 | 5.1 | Normal |
| 260 | 146 | 6.0 | 3.9 | 4.1 | 5.1 | 13.1 | 3.1 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 261 | 162 | 4.5 | 3.2 | 3.5 | 4.9 | 11.8 | 3.5 | Normal |
| 262 | 153 | 5.0 | 1.5 | 2.3 | 5.0 | 8.8 | 3.8 | Normal |
| 263 | 148 | 6.0 | 4.0 | 4.5 | 5.5 | 14.0 | 6.1 | Normal |
| 264 | 148 | 7.0 | 2.5 | 3.5 | 3.9 | 9.9 | 4.5 | Normal |
| 265 | 161 | 5.1 | 3.3 | 3.2 | 4.1 | 10.6 | 5.2 | Normal |
| 266 | 154 | 4.5 | 2.5 | 4.0 | 5.5 | 12.0 | 4.5 | Normal |
| 267 | 155 | 4.5 | 3.5 | 4.1 | 5.7 | 13.3 | 3.7 | Normal |
| 268 | 163 | 5.5 | 3.2 | 3.0 | 4.1 | 10.3 | 5.2 | Normal |
| 269 | 152 | 6.8 | 4.9 | 4.5 | 5.0 | 14.4 | 1.9 | Normal |
| 270 | 146 | 5.5 | 4.0 | 4.6 | 5.3 | 13.9 | 3.2 | Normal |
| 271 | 162 | 5.3 | 4.1 | 4.3 | 6.0 | 14.4 | 6.1 | Normal |
| 272 | 148 | 5.5 | 3.4 | 4.4 | 5.5 | 13.3 | 5.6 | Normal |
| 273 | 140 | 7.0 | 5.5 | 8.0 | 8.5 | 22.6 | 7.1 | Normal |
| 274 | 138 | 5.5 | 2.5 | 3.9 | 4.2 | 10.6 | 3.6 | Normal |
| 275 | 150 | 5.3 | 2.5 | 3.1 | 3.9 | 11.5 | 3.3 | Normal |
| 276 | 149 | 4.4 | 3.5 | 3.9 | 4.5 | 11.9 | 4.0 | Normal |
| 277 | 146 | 5.0 | 0.6 | 1.8 | 3.5 | 5.9 | 4.1 | Normal |
| 278 | 150 | 4.9 | 4.3 | 5.0 | 6.1 | 15.4 | 2.0 | Normal |
| 279 | 151 | 4.5 | 3.8 | 2.8 | 5.1 | 11.7 | 4.6 | Normal |
| 280 | 153 | 5.1 | 4.0 | 4.2 | 5.5 | 13.7 | 5.1 | Normal |
| 281 | 160 | 5.3 | 2.5 | 1.4 | 4.5 | 8.4 | 2.9 | Normal |
| 282 | 159 | 5.6 | 3.0 | 2.8 | 4.6 | 10.4 | 3.2 | Normal |
| 283 | 167 | 5.5 | 3.3 | 3.2 | 4.0 | 10.5 | 5.0 | Normal |
| 284 | 170 | 6.0 | 1.3 | 2.5 | 4.5 | 8.3 | 5.5 | Normal |
| 285 | 169.5 | 6.1 | 1.0 | 2.0 | 3.5 | 6.5 | 5.9 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 286 | 175 | 6.9 | 3.3 | 3.5 | 4.1 | 10.9 | 4.6 | Normal |
| 287 | 172 | 7.2 | 2.6 | 2.9 | 3.5 | 9.0 | 5.6 | Normal |
| 288 | 176 | 5.6 | 0.1 | 0.5 | 3.0 | 3.6 | 4.1 | Normal |
| 289 | 177 | 4.9 | 0.5 | 0.9 | 2.5 | 3.9 | 4.5 | Normal |
| 290 | 147 | 6.9 | 2.4 | 3.2 | 3.6 | 9.2 | 3.5 | Normal |
| 291 | 147 | 7.0 | 2.7 | 2.1 | 4.0 | 8.8 | 4.9 | Normal |
| 292 | 160 | 5.2 | 3.0 | 3.2 | 3.9 | 10.1 | 5.0 | Normal |
| 293 | 154 | 4.6 | 2.6 | 3.9 | 5.5 | 12.0 | 4.5 | Normal |
| 294 | 150 | 7.1 | 5.0 | 4.9 | 5.7 | 15.6 | 2.9 | Normal |
| 295 | 149 | 5.1 | 3.5 | 4.5 | 5.5 | 13.5 | 5.1 | Normal |
| 296 | 147 | 5.0 | 4.5 | 5.0 | 6.0 | 15.5 | 4.9 | Normal |
| 297 | 157 | 5.2 | 2.5 | 3.5 | 3.9 | 9.9 | 5.0 | Normal |
| 298 | 148 | 5.9 | 4.5 | 4.9 | 6.1 | 15.5 | 4.7 | Normal |
| 299 | 156 | 4.9 | 3.0 | 3.9 | 6.5 | 13.4 | 4.5 | Normal |
| 300 | 155 | 4.7 | 3.2 | 4.3 | 5.5 | 13.0 | 3.5 | Normal |
| 301 | 160 | 4.9 | 3.1 | 3.6 | 4.1 | 10.8 | 4.3 | Normal |
| 302 | 163 | 5.5 | 3.3 | 3.1 | 3.9 | 10.3 | 5.2 | Normal |
| 303 | 170 | 6.7 | 3.2 | 3.9 | 4.5 | 11.6 | 6.0 | Normal |
| 304 | 173 | 8.0 | 3.1 | 3.6 | 4.7 | 11.4 | 6.1 | Normal |
| 305 | 154 | 4.9 | 0.2 | 2.2 | 4.4 | 6.8 | 4.1 | Normal |
| 306 | 164 | 5.3 | 1.2 | 2.7 | 5.5 | 9.4 | 4.3 | Normal |
| 307 | 159 | 5.7 | 1.0 | 0.5 | 3.5 | 5.0 | 3.5 | Normal |
| 308 | 156 | 6.0 | 2.7 | 4.0 | 3.7 | 10.4 | 3.9 | Normal |
| 309 | 169 | 5.7 | 1.9 | 1.6 | 3.9 | 7.4 | 3.5 | Normal |
| 310 | 168 | 4.5 | 4.3 | 4.1 | 3.7 | 12.1 | 5.2 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 311 | 159 | 5.3 | 2.7 | 2.9 | 4.5 | 10.1 | 4.6 | Normal |
| 312 | 144 | 6.1 | 3.3 | 3.5 | 5.9 | 12.7 | 4.5 | Normal |
| 313 | 147 | 5.8 | 3.2 | 4.1 | 5.8 | 13.1 | 3.9 | Normal |
| 314 | 151 | 5.5 | 3.9 | 3.4 | 5.5 | 12.8 | 5.3 | Normal |
| 315 | 173 | 6.2 | 4.9 | 4.6 | 5.9 | 15.4 | 6.1 | Normal |
| 316 | 164 | 5.4 | 1.2 | 2.9 | 5.6 | 9.7 | 5.3 | Normal |
| 317 | 140 | 5.0 | 0.8 | 1.7 | 3.8 | 6.3 | 3.7 | Normal |
| 318 | 166 | 7.3 | 3.5 | 3.5 | 6.7 | 13.7 | 6.0 | Normal |
| 319 | 167 | 5.9 | 2.9 | 2.4 | 4.6 | 9.9 | 4.9 | Normal |
| 320 | 170 | 7.1 | 1.9 | 1.5 | 3.5 | 6.9 | 5.4 | Normal |
| 321 | 147 | 6.0 | 3.4 | 3.7 | 5.9 | 13.0 | 3.7 | Normal |
| 322 | 161 | 6.0 | 2.3 | 2.3 | 5.1 | 9.7 | 5.6 | Normal |
| 323 | 145 | 5.1 | 3.1 | 4.1 | 5.5 | 12.7 | 4.5 | Normal |
| 324 | 147 | 4.9 | 1.5 | 2.9 | 5.1 | 9.5 | 3.6 | Normal |
| 325 | 142 | 5.4 | 2.3 | 3.1 | 5.3 | 10.7 | 2.1 | Normal |
| 326 | 165 | 5.1 | 3.8 | 4.1 | 5.5 | 13.4 | 3.1 | Normal |
| 327 | 162 | 5.2 | 4.0 | 4.2 | 5.4 | 13.6 | 3.9 | Normal |
| 328 | 159 | 5.1 | 3.2 | 2.5 | 3.9 | 9.6 | 3.7 | Normal |
| 329 | 153 | 3.9 | 0.5 | 0.9 | 2.6 | 4.0 | 3.5 | Normal |
| 330 | 155 | 5.2 | 3.4 | 3.5 | 3.8 | 10.7 | 4.1 | Normal |
| 331 | 150 | 5.3 | 1.9 | 1.1 | 3.1 | 6.1 | 2.9 | Normal |
| 332 | 167 | 6.3 | 3.9 | 3.9 | 5.1 | 12.9 | 5.9 | Normal |
| 333 | 168 | 6.5 | 4.5 | 4.1 | 5.3 | 13.9 | 6.2 | Normal |
| 334 | 158 | 5.3 | 3.3 | 3.1 | 3.7 | 10.1 | 3.9 | Normal |
| 335 | 165 | 3.5 | 1.2 | 2.9 | 5.3 | 9.4 | 5.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 336 | 170 | 5.3 | 2.5 | 3.5 | 6.5 | 12.5 | 6.1 | Normal |
| 337 | 156 | 6.5 | 1.8 | 0.7 | 3.5 | 6.2 | 4.6 | Normal |
| 338 | 157 | 3.6 | 1.4 | 3.1 | 5.5 | 10.0 | 3.7 | Normal |
| 339 | 150 | 3.5 | 0.3 | 1.5 | 4.6 | 6.4 | 3.5 | Normal |
| 340 | 150 | 3.9 | 3.3 | 3.7 | 4.2 | 11.2 | 4.5 | Normal |
| 341 | 164 | 6.9 | 3.5 | 4.1 | 5.1 | 12.7 | 5.1 | Normal |
| 342 | 149 | 5.4 | 3.1 | 2.0 | 3.1 | 8.2 | 2.9 | Normal |
| 343 | 162 | 6.3 | 1.5 | 1.1 | 3.7 | 6.3 | 5.1 | Normal |
| 344 | 161 | 3.6 | 1.2 | 1.5 | 4.5 | 7.2 | 4.1 | Normal |
| 345 | 169 | 6.5 | 3.7 | 3.5 | 5.9 | 13.1 | 6.7 | Normal |
| 346 | 146 | 4.9 | 1.8 | 1.9 | 5.5 | 9.2 | 6.5 | Normal |
| 347 | 162 | 4.6 | 2.0 | 3.1 | 4.9 | 10.0 | 5.6 | 'L' |
| 348 | 146 | 3.5 | 2.1 | 3.2 | 6.0 | 11.3 | 3.5 | Normal |
| 349 | 148 | 5.2 | 3.3 | 3.6 | 6.5 | 13.4 | 3.3 | Normal |
| 350 | 171 | 6.5 | 1.9 | 0.2 | 3.0 | 5.1 | 5.9 | Normal |
| 351 | 150 | 4.9 | 1.5 | 2.5 | 5.1 | 9.1 | 5.1 | Normal |
| 352 | 156 | 4.5 | 2.5 | 2.0 | 4.5 | 9.0 | 5.1 | Normal |
| 353 | 161 | 4.5 | 1.0 | 0.5 | 2.5 | 4.0 | 4.5 | Normal |
| 354 | 143 | 4.4 | 1.7 | 2.5 | 4.0 | 8.2 | 4.5 | Normal |
| 355 | 145 | 6.1 | 3.5 | 4.1 | 6.5 | 14.1 | 3.5 | Normal |
| 356 | 161 | 6.2 | 4.5 | 4.6 | 5.9 | 15.0 | 6.5 | Normal |
| 357 | 171 | 7.0 | 3.2 | 2.5 | 3.5 | 9.2 | 4.5 | Normal |
| 358 | 155 | 5.5 | 3.0 | 4.0 | 5.5 | 12.5 | 3.5 | Normal |
| 359 | 158 | 5.5 | 1.8 | 1.8 | 3.5 | 7.1 | 4.5 | Normal |
| 360 | 166 | 6.5 | 3.0 | 1.5 | 3.0 | 7.5 | 5.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 361 | 162 | 6.5 | 3.2 | 2.5 | 4.5 | 10.2 | 5.1 | Normal |
| 362 | 165 | 4.5 | 1.4 | 2.5 | 4.5 | 8.4 | 5.5 | Normal |
| 363 | 171 | 7.3 | 5.5 | 5.5 | 5.0 | 16.0 | 6.1 | Normal |
| 364 | 146 | 5.5 | 4.8 | 4.5 | 5.5 | 14.8 | 5.6 | Normal |
| 365 | 158 | 6.5 | 3.5 | 2.9 | 3.5 | 9.9 | 4.5 | Normal |
| 366 | 156 | 6.5 | 3.9 | 3.9 | 6.5 | 14.3 | 6.5 | Normal |
| 367 | 142 | 5.5 | 3.5 | 3.7 | 5.1 | 12.3 | 3.5 | Normal |
| 368 | 162 | 6.5 | 3.5 | 2.5 | 3.8 | 9.8 | 5.2 | Normal |
| 369 | 160 | 6.6 | 3.9 | 3.9 | 6.3 | 14.1 | 6.5 | Both Flat |
| 370 | 170 | 5.2 | 2.5 | 2.5 | 3.5 | 8.5 | 4.5 | Normal |
| 371 | 155 | 4.8 | 3.1 | 3.9 | 6.0 | 13.0 | 4.5 | Normal |
| 372 | 145 | 5.2 | 3.4 | 3.7 | 5.1 | 12.2 | 3.0 | Normal |
| 373 | 165 | 6.5 | 3.8 | 2.5 | 3.8 | 10.1 | 5.2 | Normal |
| 374 | 160 | 6.5 | 3.7 | 3.9 | 6.6 | 14.2 | 6.5 | Normal |
| 375 | 151 | 4.5 | 3.2 | 3.5 | 5.0 | 11.7 | 3.5 | Normal |
| 376 | 160 | 4.9 | 4.2 | 5.0 | 7.0 | 16.2 | 6.5 | Normal |
| 377 | 155 | 3.0 | 1.2 | 2.4 | 5.4 | 9.0 | 4.5 | Normal |
| 378 | 150 | 5.9 | 4.0 | 5.3 | 7.3 | 16.6 | 3.9 | Normal |
| 379 | 160 | 6.2 | 2.5 | 2.5 | 4.0 | 9.0 | 6.2 | Normal |
| 380 | 152 | 5.5 | 2.7 | 2.5 | 5.5 | 10.7 | 5.0 | Normal |
| 381 | 170 | 5.5 | 2.5 | 3.0 | 3.5 | 9.0 | 5.5 | Normal |
| 382 | 171 | 5.2 | 3.5 | 4.1 | 5.5 | 13.1 | 5.5 | Normal |
| 383 | 143 | 5.0 | 4.0 | 5.0 | 6.5 | 15.5 | 3.0 | Normal |
| 384 | 152 | 5.2 | 3.8 | 3.3 | 5.1 | 12.2 | 4.5 | Normal |
| 385 | 164 | 3.5 | 1.0 | 0.5 | 2.6 | 4.1 | 3.7 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 386 | 155 | 4.5 | 3.6 | 4.3 | 6.4 | 14.3 | 6.0 | Normal |
| 387 | 158 | 5.3 | 2.5 | 1.4 | 2.5 | 6.4 | 2.8 | Normal |
| 388 | 152 | 5.0 | 2.3 | 3.0 | 4.8 | 10.1 | 5.4 | Normal |
| 389 | 160 | 3.8 | 1.3 | 2.2 | 5.4 | 8.9 | 4.0 | Normal |
| 390 | 162 | 5.5 | 2.5 | 1.8 | 3.9 | 8.2 | 4.5 | Normal |
| 391 | 150 | 3.8 | 1.5 | 2.1 | 5.0 | 8.6 | 2.0 | Normal |
| 392 | 165 | 6.5 | 2.9 | 1.4 | 4.1 | 8.4 | 6.3 | Normal |
| 393 | 171 | 6.1 | 1.0 | 1.0 | 2.7 | 4.7 | 6.5 | Normal |
| 394 | 163 | 6.0 | 3.0 | 3.0 | 5.1 | 11.1 | 3.5 | Normal |
| 395 | 149 | 4.1 | 0.6 | 1.5 | 3.7 | 5.8 | 4.0 | Normal |
| 396 | 156 | 4.4 | 2.5 | 2.1 | 4.6 | 9.2 | 6.5 | Normal |
| 397 | 148 | 4.2 | 1.0 | 1.0 | 3.5 | 5.5 | 1.9 | Normal |
| 398 | 153 | 4.5 | 1.0 | 1.0 | 2.9 | 4.9 | 3.0 | Normal |
| 399 | 160 | 5.0 | 0.7 | 1.3 | 3.2 | 5.2 | 3.5 | Normal |
| 400 | 151 | 5.6 | 2.0 | 1.7 | 4.0 | 7.7 | 5.0 | Normal |
| 401 | 158 | 6.1 | 1.5 | 0.5 | 1.5 | 3.5 | 3.5 | Normal |
| 402 | 169 | 5.0 | 0.9 | 2.2 | 3.5 | 6.6 | 5.0 | Normal |
| 403 | 176 | 4.5 | 0.2 | 0.5 | 2.0 | 2.7 | 4.5 | Normal |
| 404 | 159 | 5.5 | 3.0 | 5.2 | 6.5 | 14.7 | 5.5 | Normal |
| 405 | 171 | 7.0 | 1.9 | 1.0 | 3.0 | 5.9 | 5.5 | Normal |
| 406 | 159 | 6.4 | 1.7 | 0.7 | 3.7 | 6.1 | 3.9 | Normal |
| 407 | 171 | 5.2 | 2.3 | 3.4 | 6.3 | 12.0 | 6.2 | Normal |
| 408 | 167 | 3.9 | 1.4 | 3.3 | 5.6 | 10.3 | 5.3 | Normal |
| 409 | 158 | 5.4 | 3.3 | 3.0 | 3.8 | 10.1 | 3.4 | Normal |
| 410 | 169 | 6.7 | 4.7 | 3.9 | 5.4 | 14.0 | 6.1 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 411 | 168 | 6.0 | 4.2 | 4.0 | 5.3 | 13.5 | 5.7 | Normal |
| 412 | 151 | 5.2 | 1.6 | 1.0 | 3.1 | 5.7 | 2.5 | Normal |
| 413 | 155 | 5.2 | 3.4 | 3.4 | 3.9 | 10.7 | 3.9 | Normal |
| 414 | 152 | 4.1 | 0.9 | 1.6 | 2.6 | 5.1 | 2.9 | Normal |
| 415 | 160 | 4.9 | 0.9 | 0.7 | 2.9 | 4.5 | 1.9 | Normal |
| 416 | 175 | 6.5 | 3.1 | 1.6 | 2.6 | 7.3 | 4.5 | Normal |
| 417 | 160 | 5.5 | 2.9 | 3.2 | 3.9 | 10.0 | 3.7 | Normal |
| 418 | 142 | 4.1 | 0.9 | 2.3 | 5.5 | 8.7 | 3.0 | Normal |
| 419 | 156 | 4.3 | 0.8 | 2.4 | 4.9 | 8.1 | 2.5 | Normal |
| 420 | 140 | 5.2 | 2.5 | 3.2 | 5.5 | 11.2 | 3.5 | Normal |
| 421 | 155 | 5.6 | 3.7 | 3.5 | 4.1 | 11.3 | 3.9 | Normal |
| 422 | 157 | 5.5 | 3.2 | 3.5 | 3.9 | 10.6 | 3.7 | Normal |
| 423 | 150 | 4.5 | 0.2 | 1.5 | 4.5 | 6.2 | 2.7 | Normal |
| 424 | 164 | 6.8 | 3.2 | 3.7 | 5.1 | 12.0 | 4.6 | Normal |
| 425 | 149 | 5.5 | 3.2 | 2.1 | 2.9 | 8.2 | 3.5 | Normal |
| 426 | 162 | 6.6 | 1.8 | 0.7 | 3.5 | 6.0 | 5.2 | Normal |
| 427 | 160 | 4.3 | 1.0 | 1.9 | 5.3 | 8.2 | 4.1 | Normal |
| 428 | 161 | 5.0 | 1.5 | 3.1 | 5.6 | 10.2 | 6.0 | Normal |
| 429 | 167 | 6.5 | 3.5 | 3.2 | 5.8 | 12.5 | 5.9 | Normal |
| 430 | 150 | 4.9 | 0.5 | 2.5 | 4.1 | 7.1 | 3.1 | Normal |
| 431 | 166 | 5.1 | 1.9 | 3.1 | 5.5 | 10.5 | 5.8 | Normal |
| 432 | 147 | 4.9 | 2.5 | 3.5 | 6.0 | 12.0 | 3.9 | Normal |
| 433 | 162 | 5.3 | 2.9 | 3.8 | 5.6 | 12.3 | 3.7 | Normal |
| 434 | 146 | 4.7 | 3.3 | 3.7 | 6.3 | 13.3 | 3.4 | Normal |
| 435 | 156 | 4.5 | 3.5 | 3.2 | 4.1 | 11.0 | 3.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 436 | 177 | 5.9 | 1.2 | 0.7 | 4.3 | 6.2 | 4.5 | Normal |
| 437 | 150 | 4.5 | 3.5 | 3.9 | 4.5 | 11.9 | 3.4 | Normal |
| 438 | 156 | 5.5 | 1.8 | 1.5 | 3.5 | 6.8 | 5.1 | Normal |
| 439 | 155 | 5.3 | 3.1 | 3.5 | 4.1 | 10.7 | 5.3 | Normal |
| 440 | 161 | 6.5 | 3.3 | 2.7 | 3.9 | 9.9 | 5.4 | Normal |
| 441 | 160 | 6.2 | 3.5 | 4.0 | 4.2 | 11.7 | 5.1 | Normal |
| 442 | 159 | 3.5 | 1.0 | 0.6 | 2.3 | 3.9 | 3.0 | Normal |
| 443 | 166 | 5.0 | 1.4 | 1.6 | 3.7 | 6.7 | 5.9 | Normal |
| 444 | 140 | 5.5 | 4.0 | 4.5 | 5.9 | 14.4 | 3.5 | Normal |
| 445 | 136 | 5.2 | 3.5 | 4.0 | 4.4 | 11.9 | 5.0 | Normal |
| 446 | 134 | 5.0 | 3.9 | 4.2 | 5.4 | 13.5 | 4.1 | Normal |
| 447 | 152 | 5.6 | 4.1 | 4.7 | 5.1 | 13.9 | 4.7 | Normal |
| 448 | 145 | 5.1 | 2.5 | 3.1 | 5.4 | 11.0 | 5.1 | Normal |
| 449 | 150 | 5.3 | 3.7 | 4.1 | 5.3 | 13.1 | 5.5 | Normal |
| 450 | 158 | 5.6 | 3.4 | 3.9 | 3.6 | 10.9 | 3.6 | Normal |
| 451 | 150 | 5.7 | 2.6 | 3.6 | 5.9 | 12.1 | 4.2 | Normal |
| 452 | 146 | 4.9 | 2.3 | 4.2 | 5.9 | 12.4 | 2.7 | Both Flat |
| 453 | 148 | 5.2 | 2.6 | 3.7 | 5.4 | 11.7 | 3.7 | Normal |
| 454 | 154 | 5.4 | 2.4 | 3.6 | 5.6 | 11.6 | 3.3 | Normal |
| 455 | 151 | 5.3 | 2.7 | 2.1 | 5.3 | 10.1 | 2.5 | Normal |
| 456 | 150 | 5.0 | 1.5 | 2.5 | 6.4 | 10.4 | 3.8 | Normal |
| 457 | 147 | 4.9 | 3.5 | 5.7 | 6.1 | 15.3 | 3.5 | Normal |
| 458 | 155 | 6.5 | 3.9 | 3.3 | 4.9 | 12.1 | 4.1 | Normal |
| 459 | 150 | 6.6 | 3.4 | 3.8 | 5.4 | 12.6 | 3.5 | Normal |
| 460 | 155 | 6.3 | 4.0 | 3.3 | 5.3 | 12.6 | 4.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 461 | 158 | 5.1 | 0.5 | 0.4 | 3.6 | 4.5 | 4.2 | Normal |
| 462 | 142 | 3.5 | 0.5 | 0.8 | 4.5 | 5.8 | 2.9 | Normal |
| 463 | 170 | 6.3 | 3.5 | 3.9 | 5.1 | 12.5 | 6.0 | Normal |
| 464 | 156 | 5.5 | 3.5 | 3.1 | 5.7 | 12.3 | 5.7 | Normal |
| 465 | 166 | 6.0 | 4.5 | 3.0 | 3.7 | 11.2 | 4.3 | Normal |
| 466 | 172 | 7.0 | 5.6 | 5.1 | 5.4 | 16.1 | 5.4 | Normal |
| 467 | 164 | 4.2 | 1.3 | 2.7 | 5.5 | 9.5 | 4.7 | Normal |
| 468 | 176 | 5.1 | 0.3 | 0.7 | 2.5 | 3.5 | 4.3 | Normal |
| 469 | 158 | 5.5 | 2.5 | 2.5 | 6.0 | 11.0 | 6.3 | Normal |
| 470 | 158 | 5.0 | 2.5 | 2.7 | 5.3 | 10.5 | 3.9 | Normal |
| 471 | 174 | 7.0 | 4.9 | 3.8 | 4.6 | 13.3 | 5.5 | Normal |
| 472 | 169 | 6.5 | 3.5 | 3.9 | 3.5 | 10.9 | 3.7 | Normal |
| 473 | 160 | 5.5 | 3.5 | 4.0 | 5.1 | 12.6 | 5.5 | Normal |
| 474 | 173 | 5.2 | 3.7 | 3.7 | 3.5 | 10.9 | 5.2 | Normal |
| 475 | 168 | 5.2 | 4.1 | 4.0 | 3.8 | 11.9 | 4.7 | Normal |
| 476 | 159 | 5.1 | 3.6 | 3.4 | 5.4 | 12.4 | 5.0 | Normal |
| 477 | 173 | 6.3 | 2.5 | 3.1 | 5.5 | 11.1 | 5.6 | Normal |
| 478 | 164 | 5.1 | 2.3 | 2.5 | 5.0 | 9.8 | 6.1 | Normal |
| 479 | 145 | 5.0 | 4.4 | 5.4 | 4.5 | 14.3 | 6.0 | Normal |
| 480 | 160 | 5.7 | 3.3 | 1.2 | 2.5 | 7.0 | 4.5 | Normal |
| 481 | 169 | 6.9 | 4.2 | 3.6 | 5.3 | 13.1 | 5.5 | Normal |
| 482 | 160 | 5.5 | 2.5 | 2.0 | 3.8 | 8.3 | 4.3 | Normal |
| 483 | 162 | 5.6 | 4.1 | 3.2 | 5.1 | 12.4 | 4.4 | Normal |
| 484 | 171 | 6.0 | 5.0 | 3.3 | 4.3 | 12.6 | 6.1 | Normal |
| 485 | 153 | 4.9 | 1.8 | 2.5 | 5.1 | 9.4 | 5.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 486 | 162 | 6.2 | 5.5 | 6.5 | 5.0 | 17.0 | 5.1 | Normal |
| 487 | 151 | 5.3 | 4.0 | 3.2 | 4.5 | 11.7 | 4.0 | Normal |
| 488 | 155 | 5.4 | 3.5 | 3.9 | 4.3 | 11.7 | 4.3 | Normal |
| 489 | 145 | 4.9 | 3.0 | 2.6 | 3.7 | 9.3 | 2.7 | Normal |
| 490 | 155 | 5.5 | 2.3 | 0.9 | 2.6 | 5.8 | 3.8 | Normal |
| 491 | 156 | 5.1 | 3.4 | 3.7 | 4.5 | 11.6 | 4.7 | Normal |
| 492 | 141 | 5.1 | 3.0 | 3.5 | 5.3 | 11.8 | 4.5 | Normal |
| 493 | 150 | 5.0 | 3.2 | 3.5 | 5.1 | 11.8 | 4.5 | Normal |
| 494 | 171 | 6.7 | 1.3 | 2.0 | 4.5 | 7.8 | 5.5 | Normal |
| 495 | 155 | 5.5 | 3.2 | 3.9 | 5.7 | 12.8 | 4.0 | Normal |
| 496 | 159 | 5.5 | 3.0 | 2.5 | 4.5 | 10.0 | 4.1 | Normal |
| 497 | 145 | 4.5 | 3.2 | 3.7 | 5.5 | 12.4 | 2.7 | Normal |
| 498 | 140 | 5.4 | 3.1 | 3.6 | 4.4 | 11.1 | 2.0 | Normal |
| 499 | 150 | 5.5 | 2.6 | 3.0 | 4.5 | 10.1 | 2.3 | Normal |
| 500 | 139 | 5.3 | 2.7 | 4.5 | 7.1 | 14.3 | 4.7 | Normal |
| 501 | 151 | 4.9 | 2.9 | 2.7 | 4.6 | 10.2 | 5.3 | Normal |
| 502 | 140 | 4.5 | 2.6 | 4.7 | 5.5 | 12.8 | 4.7 | Normal |
| 503 | 135 | 5.5 | 2.6 | 4.1 | 5.3 | 12.0 | 3.5 | Normal |
| 504 | 170 | 5.3 | 4.5 | 4.1 | 5.2 | 13.8 | 3.3 | Normal |
| 505 | 160 | 6.0 | 3.5 | 3.2 | 3.8 | 10.5 | 2.0 | Normal |
| 506 | 159 | 6.8 | 3.5 | 2.3 | 4.2 | 10.0 | 4.4 | Normal |
| 507 | 157 | 6.8 | 3.3 | 3.6 | 4.5 | 11.4 | 3.9 | Normal |
| 508 | 148 | 4.1 | 3.9 | 3.9 | 5.2 | 13.0 | 3.1 | Normal |
| 509 | 152 | 5.4 | 2.5 | 2.9 | 4.7 | 10.1 | 4.3 | Normal |
| 510 | 165 | 5.6 | 2.9 | 3.9 | 5.7 | 12.5 | 7.3 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 511 | 167 | 5.9 | 3.0 | 3.5 | 4.6 | 11.1 | 3.7 | Normal |
| 512 | 164 | 6.1 | 2.7 | 2.9 | 3.1 | 8.7 | 5.4 | Normal |
| 513 | 169 | 7.0 | 2.9 | 1.9 | 3.9 | 8.7 | 4.5 | Normal |
| 514 | 165 | 7.1 | 5.1 | 5.7 | 6.4 | 17.2 | 5.5 | Normal |
| 515 | 151 | 5.3 | 4.1 | 3.7 | 4.5 | 12.3 | 4.1 | Normal |
| 516 | 157 | 6.6 | 4.2 | 4.7 | 5.6 | 14.5 | 6.4 | Normal |
| 517 | 169 | 8.1 | 4.1 | 3.1 | 4.6 | 11.8 | 5.5 | Normal |
| 518 | 168 | 6.6 | 3.1 | 2.5 | 2.7 | 8.3 | 5.5 | Normal |
| 519 | 167 | 4.5 | 1.3 | 1.5 | 4.6 | 7.4 | 5.0 | Normal |
| 520 | 160 | 5.4 | 2.3 | 3.3 | 5.7 | 11.3 | 5.7 | Normal |
| 521 | 150 | 4.7 | 4.7 | 5.9 | 4.1 | 14.7 | 3.5 | Normal |
| 522 | 160 | 5.6 | 1.2 | 1.0 | 2.5 | 4.7 | 3.7 | Normal |
| 523 | 166 | 5.8 | 1.5 | 0.9 | 3.1 | 5.5 | 5.1 | Normal |
| 524 | 169 | 6.2 | 4.5 | 2.5 | 5.5 | 12.5 | 5.7 | Normal |
| 525 | 155 | 4.6 | 1.3 | 2.6 | 5.5 | 9.4 | 4.0 | Normal |
| 526 | 148 | 5.8 | 3.1 | 4.7 | 6.5 | 14.3 | 3.7 | Normal |
| 527 | 160 | 5.9 | 2.7 | 3.5 | 4.2 | 10.4 | 6.0 | Normal |
| 528 | 152 | 5.3 | 0.8 | 0.9 | 3.5 | 5.2 | 3.5 | Normal |
| 529 | 145 | 4.4 | 2.0 | 3.3 | 6.0 | 11.3 | 3.7 | Normal |
| 530 | 160 | 4.9 | 1.3 | 3.0 | 4.9 | 9.2 | 4.9 | Normal |
| 531 | 146 | 5.0 | 1.0 | 2.1 | 3.5 | 6.6 | 3.5 | Normal |
| 532 | 166 | 6.1 | 3.5 | 3.3 | 5.1 | 11.9 | 6.7 | Normal |
| 533 | 160 | 5.4 | 2.1 | 3.1 | 5.9 | 11.1 | 6.0 | Normal |
| 534 | 161 | 3.9 | 0.9 | 1.5 | 3.5 | 5.9 | 4.7 | Normal |
| 535 | 162 | 6.5 | 1.5 | 0.7 | 3.5 | 5.7 | 5.1 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 536 | 165 | 6.7 | 3.5 | 3.9 | 5.1 | 12.5 | 5.1 | Normal |
| 537 | 158 | 5.6 | 2.5 | 3.0 | 5.0 | 10.5 | 3.9 | Normal |
| 538 | 134 | 4.5 | 2.7 | 3.5 | 5.5 | 11.7 | 3.9 | Normal |
| 539 | 140 | 4.7 | 3.1 | 4.5 | 5.0 | 12.6 | 3.7 | 'R' |
| 540 | 152 | 6.3 | 3.2 | 4.5 | 5.5 | 13.2 | 3.6 | Normal |
| 541 | 137 | 5.5 | 3.1 | 3.7 | 6.1 | 12.9 | 4.6 | Normal |
| 542 | 149 | 6.0 | 2.4 | 3.5 | 5.5 | 11.4 | 2.9 | Normal |
| 543 | 140 | 5.0 | 3.5 | 4.5 | 5.7 | 13.7 | 4.2 | Normal |
| 544 | 142 | 5.2 | 3.2 | 4.1 | 5.1 | 12.7 | 4.3 | Normal |
| 545 | 159 | 5.4 | 2.7 | 3.6 | 5.8 | 12.1 | 4.5 | Normal |
| 546 | 151 | 5.3 | 3.5 | 4.5 | 5.1 | 13.1 | 5.0 | Normal |
| 547 | 174 | 6.7 | 3.0 | 3.5 | 5.6 | 12.1 | 4.5 | Normal |
| 548 | 150 | 5.1 | 3.7 | 3.9 | 5.0 | 12.6 | 4.0 | Normal |
| 549 | 142 | 4.5 | 3.5 | 3.4 | 5.1 | 12.0 | 2.4 | Normal |
| 550 | 150 | 6.0 | 4.1 | 4.5 | 5.5 | 14.1 | 3.0 | Normal |
| 551 | 150 | 5.1 | 3.7 | 3.9 | 4.5 | 12.1 | 3.5 | Normal |
| 552 | 155 | 6.5 | 3.8 | 3.9 | 6.3 | 14.0 | 4.1 | Normal |
| 553 | 145 | 5.2 | 3.0 | 2.5 | 5.9 | 11.4 | 5.0 | Normal |
| 554 | 155 | 6.1 | 3.9 | 2.5 | 5.4 | 11.8 | 5.4 | Normal |
| 555 | 150 | 5.3 | 4.0 | 3.0 | 4.5 | 11.5 | 5.1 | Normal |
| 556 | 161 | 5.6 | 3.5 | 3.3 | 5.5 | 12.3 | 5.3 | Normal |
| 557 | 154 | 5.3 | 1.5 | 1.9 | 3.4 | 6.8 | 3.9 | Normal |
| 558 | 169 | 6.5 | 4.5 | 3.5 | 4.5 | 12.5 | 5.5 | Normal |
| 559 | 165 | 5.7 | 3.2 | 2.9 | 5.0 | 11.1 | 5.0 | Normal |
| 560 | 170 | 6.2 | 3.4 | 3.6 | 5.0 | 12.0 | 5.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 561 | 159 | 5.6 | 3.0 | 2.1 | 4.9 | 10.0 | 4.9 | Normal |
| 562 | 145 | 5.7 | 3.4 | 4.4 | 5.0 | 12.8 | 4.5 | Normal |
| 563 | 164 | 4.9 | 2.5 | 3.0 | 5.7 | 11.2 | 5.7 | Normal |
| 564 | 170 | 5.5 | 2.9 | 1.0 | 4.2 | 8.1 | 4.5 | Normal |
| 565 | 160 | 4.6 | 3.5 | 1.9 | 3.7 | 9.1 | 3.9 | Normal |
| 566 | 163 | 6.5 | 1.0 | 0.9 | 2.9 | 4.8 | 4.3 | Normal |
| 567 | 146 | 5.7 | 3.7 | 3.5 | 5.1 | 12.3 | 5.1 | Normal |
| 568 | 156 | 5.6 | 1.5 | 1.0 | 3.1 | 5.6 | 4.5 | Normal |
| 569 | 167 | 6.8 | 3.3 | 3.0 | 3.5 | 9.8 | 5.0 | Normal |
| 570 | 145 | 5.2 | 0.9 | 2.0 | 5.0 | 7.9 | 3.5 | Normal |
| 571 | 151 | 5.4 | 2.9 | 2.1 | 5.4 | 10.4 | 4.7 | Normal |
| 572 | 154 | 5.5 | 3.5 | 3.0 | 4.9 | 11.4 | 4.6 | Normal |
| 573 | 145 | 5.3 | 4.1 | 3.5 | 4.7 | 12.3 | 2.5 | Normal |
| 574 | 140 | 3.9 | 1.0 | 2.0 | 3.9 | 6.9 | 3.9 | Normal |
| 575 | 137 | 5.5 | 4.5 | 4.2 | 5.0 | 13.7 | 4.6 | Normal |
| 576 | 141 | 5.0 | 3.5 | 3.2 | 5.5 | 12.2 | 4.9 | Normal |
| 577 | 143 | 5.7 | 3.3 | 4.1 | 4.8 | 12.2 | 3.8 | Normal |
| 578 | 147 | 4.7 | 3.4 | 2.9 | 5.0 | 11.3 | 4.5 | Normal |
| 579 | 141 | 5.2 | 3.6 | 3.9 | 5.3 | 12.8 | 3.5 | Normal |
| 580 | 140 | 5.6 | 4.4 | 4.6 | 5.1 | 14.1 | 4.3 | Normal |
| 581 | 150 | 4.3 | 3.2 | 2.9 | 5.5 | 11.6 | 4.2 | Normal |
| 582 | 151 | 5.5 | 3.6 | 3.1 | 5.0 | 11.7 | 4.0 | Normal |
| 583 | 150 | 5.1 | 2.9 | 3.3 | 5.5 | 11.7 | 3.9 | Normal |
| 584 | 145 | 5.0 | 3.0 | 3.8 | 4.9 | 11.7 | 4.9 | Normal |
| 585 | 161 | 4.7 | 3.0 | 3.5 | 5.1 | 11.6 | 4.4 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 586 | 146 | 5.0 | 3.6 | 3.4 | 4.7 | 11.7 | 3.8 | Normal |
| 587 | 160 | 5.9 | 3.5 | 3.0 | 3.6 | 10.1 | 3.9 | Normal |
| 588 | 163 | 4.9 | 3.7 | 4.0 | 4.8 | 12.5 | 5.0 | Normal |
| 589 | 140 | 5.7 | 3.5 | 3.1 | 5.5 | 12.1 | 2.6 | Both Flat |
| 590 | 145 | 5.5 | 2.3 | 3.5 | 5.3 | 11.1 | 2.3 | Normal |
| 591 | 150 | 4.6 | 3.6 | 2.4 | 5.1 | 11.1 | 3.5 | Normal |
| 592 | 151 | 5.0 | 2.8 | 4.0 | 5.4 | 12.2 | 3.7 | Normal |
| 593 | 163 | 5.8 | 2.5 | 3.2 | 5.0 | 10.7 | 5.0 | Normal |
| 594 | 152 | 6.3 | 3.2 | 3.4 | 5.3 | 11.9 | 3.3 | Normal |
| 595 | 171 | 6.9 | 1.5 | 0.5 | 3.6 | 5.6 | 5.7 | Normal |
| 596 | 177 | 5.0 | 0.4 | 0.9 | 2.1 | 3.4 | 3.9 | Normal |
| 597 | 176 | 5.6 | 2.5 | 2.1 | 4.0 | 8.6 | 4.6 | Normal |
| 598 | 166 | 7.5 | 4.2 | 3.0 | 4.6 | 11.8 | 5.1 | Normal |
| 599 | 147 | 5.5 | 2.6 | 4.0 | 6.0 | 12.6 | 3.6 | Both Flat |
| 600 | 170 | 7.1 | 4.0 | 3.0 | 4.7 | 11.7 | 3.1 | Normal |
| 601 | 161 | 5.1 | 3.0 | 2.7 | 4.5 | 10.2 | 4.5 | Normal |
| 602 | 146 | 4.9 | 3.7 | 2.5 | 5.0 | 11.2 | 3.0 | Normal |
| 603 | 169 | 6.1 | 3.5 | 2.5 | 5.0 | 11.0 | 5.1 | Normal |
| 604 | 155 | 5.3 | 4.0 | 4.3 | 5.2 | 13.5 | 5.0 | Both Flat |
| 605 | 150 | 5.1 | 3.5 | 3.0 | 5.6 | 12.1 | 3.5 | Normal |
| 606 | 161 | 4.6 | 1.0 | 2.0 | 4.7 | 7.7 | 4.9 | Normal |
| 607 | 170 | 4.5 | 3.9 | 2.7 | 5.4 | 12.0 | 5.4 | Normal |
| 608 | 165 | 5.7 | 3.1 | 2.9 | 4.9 | 10.9 | 5.0 | Normal |
| 609 | 166 | 6.0 | 3.5 | 3.2 | 3.9 | 10.6 | 3.5 | Normal |
| 610 | 145 | 4.7 | 3.5 | 3.0 | 5.4 | 11.9 | 4.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 611 | 170 | 5.5 | 3.1 | 2.0 | 5.4 | 10.5 | 5.4 | Normal |
| 612 | 160 | 6.6 | 2.9 | 3.0 | 5.0 | 10.9 | 5.1 | Normal |
| 613 | 161 | 6.0 | 3.9 | 2.7 | 5.2 | 11.8 | 5.2 | Normal |
| 614 | 166 | 4.0 | 3.2 | 2.9 | 5.3 | 11.4 | 6.0 | Normal |
| 615 | 141 | 4.5 | 3.0 | 4.0 | 5.7 | 12.7 | 4.7 | Normal |
| 616 | 166 | 5.4 | 3.5 | 3.2 | 4.9 | 11.6 | 5.9 | Normal |
| 617 | 160 | 5.4 | 3.0 | 2.9 | 5.4 | 11.3 | 5.4 | Normal |
| 618 | 150 | 4.0 | 1.5 | 0.9 | 3.6 | 6.0 | 3.5 | Normal |
| 619 | 145 | 6.0 | 2.6 | 3.4 | 5.1 | 11.1 | 4.1 | Normal |
| 620 | 155 | 5.2 | 3.0 | 2.9 | 5.9 | 11.8 | 5.0 | Normal |
| 621 | 173 | 7.0 | 3.9 | 3.7 | 5.1 | 12.7 | 5.6 | Normal |
| 622 | 151 | 5.0 | 3.2 | 2.5 | 5.4 | 11.1 | 4.4 | Normal |
| 623 | 154 | 4.9 | 2.9 | 2.6 | 5.1 | 10.6 | 3.0 | Normal |
| 624 | 150 | 6.1 | 4.0 | 3.8 | 5.1 | 12.9 | 3.1 | Normal |
| 625 | 159 | 6.6 | 3.5 | 2.5 | 5.2 | 11.2 | 4.4 | Normal |
| 626 | 156 | 5.6 | 3.9 | 2.7 | 5.3 | 11.9 | 4.6 | Normal |
| 627 | 166 | 6.0 | 3.1 | 3.0 | 4.3 | 10.4 | 5.0 | Normal |
| 628 | 157 | 5.4 | 3.2 | 3.0 | 4.5 | 10.7 | 3.4 | Normal |
| 629 | 170 | 6.2 | 2.5 | 3.1 | 5.5 | 11.1 | 5.5 | Normal |
| 630 | 150 | 5.6 | 2.6 | 3.5 | 5.3 | 11.4 | 2.5 | Normal |
| 631 | 150 | 5.6 | 3.7 | 3.0 | 5.2 | 11.9 | 5.0 | Normal |
| 632 | 147 | 4.7 | 3.4 | 3.0 | 5.5 | 11.9 | 4.5 | Normal |
| 633 | 151 | 5.3 | 0.8 | 1.7 | 5.1 | 7.6 | 4.4 | Normal |
| 634 | 135 | 5.5 | 3.1 | 3.3 | 6.5 | 12.9 | 3.9 | Normal |
| 635 | 151 | 5.0 | 2.5 | 3.5 | 5.7 | 11.7 | 4.2 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 636 | 151 | 5.2 | 2.7 | 2.1 | 5.5 | 10.3 | 4.5 | Normal |
| 637 | 155 | 5.3 | 2.5 | 3.5 | 5.1 | 11.1 | 3.5 | Normal |
| 638 | 140 | 5.4 | 3.0 | 3.5 | 6.1 | 12.6 | 2.3 | Normal |
| 639 | 136 | 4.6 | 4.2 | 4.0 | 4.9 | 13.1 | 4.6 | Normal |
| 640 | 150 | 5.0 | 2.7 | 3.8 | 5.5 | 12.0 | 3.8 | Normal |
| 641 | 145 | 5.5 | 3.5 | 4.0 | 5.5 | 13.0 | 3.5 | Normal |
| 642 | 145 | 4.4 | 1.9 | 2.5 | 4.5 | 8.9 | 2.1 | Normal |
| 643 | 150 | 5.0 | 2.9 | 3.2 | 5.5 | 11.6 | 5.5 | Normal |
| 644 | 150 | 5.0 | 3.2 | 4.3 | 5.5 | 13.0 | 2.0 | Normal |
| 645 | 145 | 5.5 | 3.9 | 4.4 | 5.7 | 14.0 | 3.0 | Normal |
| 646 | 149 | 5.8 | 3.5 | 3.9 | 5.4 | 12.8 | 4.1 | Normal |
| 647 | 160 | 5.8 | 2.8 | 3.5 | 5.1 | 11.4 | 5.1 | Normal |
| 648 | 151 | 5.0 | 2.6 | 3.0 | 5.3 | 10.9 | 3.3 | Normal |
| 649 | 140 | 5.0 | 3.4 | 4.7 | 5.0 | 13.1 | 2.6 | Normal |
| 650 | 145 | 5.1 | 3.4 | 5.2 | 5.6 | 14.2 | 3.2 | Normal |
| 651 | 141 | 5.5 | 1.5 | 2.0 | 2.9 | 6.4 | 2.9 | Normal |
| 652 | 140 | 5.5 | 3.0 | 3.5 | 6.0 | 12.5 | 4.0 | Normal |
| 653 | 152 | 5.5 | 3.5 | 2.5 | 5.0 | 11.0 | 5.0 | Normal |
| 654 | 141 | 5.1 | 3.4 | 2.7 | 5.1 | 11.3 | 3.5 | Normal |
| 655 | 136 | 5.2 | 5.0 | 4.4 | 5.5 | 14.9 | 3.7 | Normal |
| 656 | 135 | 6.0 | 1.5 | 0.5 | 2.1 | 4.1 | 2.1 | Normal |
| 657 | 151 | 4.3 | 1.6 | 2.0 | 5.2 | 8.8 | 4.0 | Normal |
| 658 | 154 | 5.3 | 2.5 | 3.0 | 5.5 | 11.0 | 3.5 | Normal |
| 659 | 146 | 5.1 | 3.5 | 3.0 | 4.5 | 11.0 | 3.0 | Normal |
| 660 | 166 | 6.5 | 3.5 | 2.5 | 4.1 | 10.1 | 4.9 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 661 | 161 | 5.5 | 2.5 | 2.0 | 4.8 | 9.3 | 4.8 | Normal |
| 662 | 157 | 5.3 | 3.5 | 3.7 | 5.6 | 12.8 | 5.1 | Normal |
| 663 | 153 | 4.9 | 2.0 | 2.6 | 5.5 | 10.1 | 5.5 | Normal |
| 664 | 172 | 7.0 | 5.0 | 3.5 | 5.0 | 13.5 | 6.1 | Normal |
| 665 | 166 | 6.4 | 5.5 | 4.3 | 6.0 | 15.8 | 5.0 | Normal |
| 666 | 160 | 5.5 | 3.5 | 2.5 | 4.5 | 10.5 | 3.5 | Normal |
| 667 | 158 | 5.6 | 3.0 | 2.0 | 3.5 | 8.5 | 5.1 | Normal |
| 668 | 154 | 6.5 | 2.3 | 2.0 | 5.0 | 9.3 | 3.0 | Normal |
| 669 | 165 | 6.5 | 4.2 | 3.5 | 6.1 | 13.8 | 5.1 | Normal |
| 670 | 168 | 7.5 | 2.5 | 3.0 | 5.6 | 11.1 | 6.9 | Normal |
| 671 | 167 | 5.5 | 3.5 | 3.9 | 5.3 | 12.4 | 6.6 | Normal |
| 672 | 157 | 6.5 | 3.3 | 4.1 | 6.3 | 13.7 | 5.0 | Normal |
| 673 | 151 | 4.5 | 3.2 | 3.7 | 5.5 | 12.4 | 2.7 | Normal |
| 674 | 156 | 4.5 | 1.2 | 2.0 | 4.5 | 7.7 | 3.7 | Normal |
| 675 | 156 | 10.0 | 5.7 | 5.3 | 7.0 | 18.0 | 6.3 | Normal |
| 676 | 165 | 8.0 | 3.4 | 2.4 | 5.2 | 11.0 | 5.5 | Normal |
| 677 | 156 | 8.4 | 3.9 | 3.0 | 4.9 | 11.8 | 3.9 | Normal |
| 678 | 157 | 5.4 | 3.5 | 3.7 | 5.1 | 12.3 | 3.8 | 'L' |
| 679 | 164 | 3.5 | 1.3 | 1.6 | 4.6 | 7.5 | 5.8 | Normal |
| 680 | 170 | 4.4 | 1.2 | 1.2 | 3.1 | 5.5 | 4.5 | Normal |
| 681 | 158.5 | 6.0 | 2.6 | 2.2 | 3.5 | 8.3 | 5.5 | Normal |
| 682 | 157 | 8.0 | 6.1 | 5.9 | 7.9 | 19.9 | 6.9 | Normal |
| 683 | 163 | 5.1 | 3.4 | 3.5 | 6.6 | 13.5 | 6.5 | Normal |
| 684 | 153.5 | 9.0 | 5.3 | 5.0 | 6.2 | 16.5 | 4.6 | Normal |
| 685 | 167 | 5.4 | 1.9 | 1.7 | 3.5 | 7.1 | 6.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 686 | 176 | 5.2 | 3.3 | 2.5 | 4.1 | 9.9 | 4.6 | Normal |
| 687 | 163 | 10.6 | 7.2 | 5.6 | 6.9 | 19.7 | 7.6 | Normal |
| 688 | 152 | 4.8 | 1.5 | 2.3 | 5.3 | 9.1 | 4.9 | Normal |
| 689 | 170 | 5.4 | 4.5 | 5.0 | 7.5 | 17.0 | 6.7 | Normal |
| 690 | 163 | 7.2 | 2.4 | 2.0 | 3.0 | 7.4 | 1.7 | Normal |
| 691 | 162 | 10.0 | 2.0 | 1.7 | 3.0 | 6.7 | 3.8 | Normal |
| 692 | 157 | 5.0 | 2.2 | 3.0 | 5.3 | 10.5 | 5.5 | Normal |
| 693 | 164 | 9.3 | 6.0 | 6.0 | 8.5 | 20.5 | 7.9 | Normal |
| 694 | 176 | 5.1 | 2.4 | 2.0 | 3.7 | 8.1 | 7.0 | Normal |
| 695 | 162 | 7.3 | 3.5 | 2.6 | 4.6 | 10.5 | 6.0 | Normal |
| 696 | 150 | 8.7 | 4.4 | 3.5 | 4.3 | 12.2 | 5.7 | Normal |
| 697 | 144 | 5.5 | 4.5 | 5.1 | 6.6 | 16.2 | 2.9 | Normal |
| 698 | 171 | 8.9 | 2.7 | 0.8 | 2.0 | 5.5 | 4.4 | Normal |
| 699 | 160 | 8.1 | 4.5 | 4.0 | 5.7 | 14.2 | 7.5 | Normal |
| 700 | 170 | 6.7 | 3.2 | 2.3 | 5.5 | 11.0 | 6.5 | Normal |
| 701 | 151 | 10.0 | 5.5 | 5.7 | 6.4 | 17.6 | 4.3 | Normal |
| 702 | 163.5 | 8.5 | 4.5 | 3.0 | 4.0 | 11.5 | 5.0 | Normal |
| 703 | 166 | 7.1 | 4.4 | 3.5 | 3.9 | 11.8 | 5.1 | Normal |
| 704 | 160 | 5.5 | 1.6 | 1.9 | 3.9 | 7.4 | 5.4 | Normal |
| 705 | 167 | 8.0 | 1.7 | 0.9 | 3.5 | 6.1 | 5.3 | Normal |
| 706 | 160 | 6.1 | 1.2 | 1.0 | 2.7 | 4.9 | 2.3 | Normal |
| 707 | 149 | 6.8 | 5.0 | 6.2 | 5.5 | 16.7 | 2.5 | Normal |
| 708 | 161 | 5.4 | 2.3 | 3.3 | 5.8 | 11.4 | 5.7 | Normal |
| 709 | 167 | 4.5 | 1.5 | 1.5 | 4.3 | 7.3 | 4.9 | Normal |
| 710 | 169 | 6.6 | 3.0 | 1.4 | 2.6 | 7.0 | 5.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 711 | 170 | 7.9 | 4.2 | 3.5 | 4.6 | 12.3 | 5.4 | Normal |
| 712 | 156 | 8.6 | 5.0 | 4.3 | 6.6 | 15.9 | 6.8 | Normal |
| 713 | 152 | 6.5 | 4.0 | 3.6 | 4.7 | 12.3 | 4.1 | Normal |
| 714 | 166 | 8.7 | 5.0 | 5.9 | 6.5 | 17.4 | 6.4 | Normal |
| 715 | 170 | 7.0 | 3.0 | 1.8 | 3.7 | 8.5 | 4.4 | Normal |
| 716 | 165 | 6.8 | 3.0 | 1.9 | 3.0 | 7.9 | 4.7 | Normal |
| 717 | 168 | 6.0 | 2.1 | 1.4 | 2.6 | 6.1 | 3.0 | Normal |
| 718 | 165 | 5.4 | 1.9 | 4.0 | 7.4 | 13.3 | 8.2 | Normal |
| 719 | 152 | 5.6 | 2.2 | 1.5 | 3.9 | 7.6 | 5.0 | Normal |
| 720 | 142 | 5.5 | 4.0 | 5.0 | 6.8 | 15.8 | 2.0 | Normal |
| 721 | 152 | 6.2 | 3.8 | 3.3 | 5.2 | 12.3 | 4.6 | Normal |
| 722 | 155 | 6.1 | 3.5 | 3.3 | 5.1 | 11.9 | 4.1 | Normal |
| 723 | 164 | 3.4 | 1.0 | 0.5 | 2.7 | 4.2 | 3.7 | Normal |
| 724 | 165 | 3.5 | 3.2 | 3.6 | 4.2 | 11.0 | 3.5 | Normal |
| 725 | 158 | 4.5 | 3.6 | 4.3 | 6.5 | 14.4 | 6.0 | Normal |
| 726 | 155 | 4.1 | 3.4 | 4.1 | 5.5 | 13.0 | 5.1 | Normal |
| 727 | 158 | 5.3 | 2.5 | 1.4 | 2.5 | 6.4 | 2.8 | Normal |
| 728 | 154 | 5.0 | 2.4 | 3.0 | 4.9 | 10.3 | 5.3 | Normal |
| 729 | 162 | 3.8 | 1.3 | 2.3 | 5.5 | 9.1 | 4.0 | Both Flat |
| 730 | 163.5 | 5.5 | 2.5 | 1.8 | 3.8 | 8.1 | 4.5 | Normal |
| 731 | 164 | 5.5 | 2.3 | 2.9 | 3.9 | 9.1 | 4.4 | Normal |
| 732 | 149 | 3.8 | 1.5 | 2.0 | 5.0 | 8.5 | 2.0 | Normal |
| 733 | 166 | 6.4 | 2.8 | 1.4 | 4.0 | 8.2 | 6.4 | Normal |
| 734 | 171 | 6.0 | 1.0 | 1.0 | 2.6 | 4.6 | 6.4 | Normal |
| 735 | 161 | 6.0 | 3.0 | 3.0 | 5.2 | 11.2 | 3.6 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 736 | 160 | 6.1 | 3.1 | 3.5 | 3.9 | 10.5 | 3.5 | Normal |
| 737 | 155 | 4.5 | 3.5 | 3.1 | 4.5 | 11.1 | 6.5 | Normal |
| 738 | 148.5 | 4.0 | 0.7 | 1.5 | 3.7 | 5.9 | 4.0 | Normal |
| 739 | 156 | 4.5 | 2.5 | 2.1 | 4.5 | 9.1 | 7.7 | Normal |
| 740 | 147.5 | 4.1 | 1.0 | 1.0 | 3.3 | 5.3 | 1.9 | Both Flat |
| 741 | 152 | 3.1 | 1.0 | 1.0 | 2.8 | 4.8 | 3.0 | Normal |
| 742 | 159 | 5.0 | 0.7 | 1.2 | 3.0 | 4.9 | 2.5 | Normal |
| 743 | 152 | 5.8 | 2.0 | 1.5 | 4.0 | 7.5 | 5.0 | Normal |
| 744 | 155 | 5.8 | 2.5 | 3.5 | 4.5 | 10.5 | 4.5 | Normal |
| 745 | 158 | 6.1 | 1.5 | 0.5 | 1.7 | 3.7 | 3.3 | Normal |
| 746 | 167 | 5.0 | 0.8 | 2.1 | 3.5 | 6.4 | 5.0 | Normal |
| 747 | 177 | 4.6 | 0.2 | 0.6 | 1.9 | 2.7 | 4.0 | Normal |
| 748 | 156 | 6.5 | 4.0 | 5.2 | 7.8 | 17.0 | 5.5 | Normal |
| 749 | 170 | 7.0 | 1.9 | 1.0 | 3.0 | 5.9 | 5.8 | Normal |
| 750 | 146 | 4.9 | 4.2 | 5.0 | 7.1 | 16.3 | 6.6 | Normal |
| 751 | 155 | 3.0 | 1.2 | 2.4 | 5.4 | 9.0 | 4.0 | Normal |
| 752 | 149 | 5.9 | 4.0 | 5.4 | 7.5 | 16.9 | 3.8 | Normal |
| 753 | 160 | 6.2 | 2.7 | 2.5 | 4.0 | 9.2 | 6.3 | Both Flat |
| 754 | 151.5 | 5.5 | 2.7 | 2.4 | 5.5 | 10.6 | 5.0 | Normal |
| 755 | 139 | 5.5 | 2.6 | 4.0 | 7.3 | 13.9 | 3.6 | Normal |
| 756 | 169 | 7.0 | 4.7 | 3.8 | 5.0 | 13.5 | 3.0 | Normal |
| 757 | 160 | 5.1 | 3.0 | 2.8 | 4.6 | 10.4 | 3.0 | Normal |
| 758 | 145 | 4.9 | 1.8 | 2.5 | 4.9 | 9.2 | 2.8 | Normal |
| 759 | 167 | 4.5 | 1.6 | 1.3 | 2.9 | 5.8 | 5.0 | Normal |
| 760 | 156 | 5.3 | 3.9 | 4.3 | 5.5 | 13.6 | 5.7 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 761 | 155 | 5.3 | 3.7 | 4.1 | 5.4 | 13.2 | 5.1 | Normal |
| 762 | 147 | 5.9 | 3.5 | 3.5 | 6.0 | 13.0 | 2.2 | Both Flat |
| 763 | 163 | 3.9 | 1.2 | 2.6 | 5.6 | 9.4 | 4.5 | Normal |
| 764 | 169.5 | 4.0 | 1.0 | 1.7 | 4.3 | 7.0 | 5.3 | Normal |
| 765 | 164 | 4.5 | 2.0 | 2.5 | 5.1 | 9.6 | 8.3 | Normal |
| 766 | 161 | 6.0 | 3.5 | 3.2 | 3.7 | 10.4 | 2.0 | Normal |
| 767 | 144 | 4.4 | 1.5 | 3.0 | 6.0 | 10.5 | 4.0 | Normal |
| 768 | 169 | 5.5 | 1.6 | 1.0 | 2.0 | 4.6 | 2.9 | Normal |
| 769 | 158 | 6.8 | 2.7 | 2.7 | 4.3 | 9.7 | 4.5 | Normal |
| 770 | 165 | 6.0 | 1.9 | 1.7 | 4.2 | 7.8 | 5.9 | Normal |
| 771 | 168 | 3.7 | 2.1 | 2.0 | 4.4 | 8.5 | 6.1 | Normal |
| 772 | 140 | 4.5 | 2.7 | 4.6 | 7.7 | 15.0 | 4.7 | Normal |
| 773 | 162 | 5.4 | 2.0 | 1.8 | 3.4 | 7.2 | 6.0 | Normal |
| 774 | 154 | 4.2 | 2.8 | 2.6 | 4.3 | 9.6 | 2.1 | Normal |
| 775 | 148 | 4.0 | 1.6 | 0.7 | 2.4 | 4.7 | 3.0 | Normal |
| 776 | 142 | 6.4 | 2.4 | 3.0 | 4.0 | 9.4 | 2.3 | Normal |
| 777 | 155 | 5.1 | 3.8 | 3.9 | 5.9 | 13.6 | 4.5 | Normal |
| 778 | 154 | 5.2 | 3.9 | 4.2 | 8.4 | 16.5 | 4.0 | Normal |
| 779 | 173 | 7.3 | 5.7 | 5.4 | 5.0 | 16.1 | 6.0 | Normal |
| 780 | 170 | 7.1 | 5.6 | 5.4 | 5.2 | 16.2 | 5.9 | Normal |
| 781 | 152 | 5.9 | 2.9 | 2.7 | 4.6 | 10.2 | 5.3 | Normal |
| 782 | 152 | 4.8 | 1.2 | 2.0 | 5.2 | 8.4 | 3.6 | Normal |
| 783 | 148 | 7.1 | 3.1 | 3.9 | 5.0 | 12.8 | 3.0 | Normal |
| 784 | 157 | 6.8 | 3.5 | 2.3 | 4.2 | 10.0 | 4.4 | Normal |
| 785 | 161 | 4.6 | 3.0 | 3.2 | 4.8 | 11.0 | 3.3 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 786 | 144.5 | 5.0 | 2.6 | 2.4 | 4.8 | 9.8 | 2.8 | Normal |
| 787 | 139 | 5.9 | 3.2 | 2.4 | 3.7 | 9.3 | 3.5 | Normal |
| 788 | 162 | 4.8 | 4.0 | 4.4 | 5.5 | 13.9 | 2.8 | Normal |
| 789 | 165 | 4.9 | 3.9 | 4.2 | 5.5 | 13.6 | 3.5 | Normal |
| 790 | 139 | 5.7 | 2.2 | 3.1 | 5.5 | 10.8 | 2.4 | Normal |
| 791 | 142 | 5.5 | 2.4 | 3.2 | 5.2 | 10.8 | 1.4 | Normal |
| 792 | 147 | 4.0 | 1.6 | 2.0 | 4.3 | 7.9 | 1.9 | 'R' |
| 793 | 143 | 5.0 | 2.9 | 4.0 | 6.4 | 13.2 | 4.0 | Normal |
| 794 | 161 | 5.8 | 2.1 | 2.3 | 5.0 | 9.4 | 5.7 | Normal |
| 795 | 147 | 6.3 | 3.2 | 3.6 | 5.5 | 12.3 | 2.7 | Normal |
| 796 | 170 | 6.9 | 1.5 | 0.5 | 3.1 | 5.1 | 5.7 | Normal |
| 797 | 156 | 6.5 | 1.8 | 0.7 | 3.3 | 5.8 | 4.3 | Normal |
| 798 | 170 | 5.2 | 2.3 | 3.3 | 7.5 | 13.1 | 6.7 | Normal |
| 799 | 166 | 3.6 | 1.1 | 3.0 | 5.3 | 9.4 | 5.0 | Normal |
| 800 | 140 | 5.3 | 3.2 | 2.8 | 3.5 | 9.5 | 3.1 | Normal |
| 801 | 168 | 6.4 | 4.8 | 3.7 | 5.2 | 13.7 | 6.5 | Normal |
| 802 | 167 | 6.1 | 4.1 | 3.9 | 5.1 | 13.1 | 6.0 | Normal |
| 803 | 150 | 5.2 | 1.6 | 0.9 | 3.0 | 5.5 | 2.0 | Normal |
| 804 | 154 | 5.1 | 3.2 | 3.4 | 3.9 | 10.5 | 3.9 | Normal |
| 805 | 153 | 3.7 | 0.8 | 1.0 | 2.4 | 4.2 | 2.4 | Normal |
| 806 | 150 | 2.7 | 2.2 | 2.0 | 4.0 | 8.2 | 3.0 | Normal |
| 807 | 159 | 4.3 | 0.8 | 0.6 | 2.7 | 4.1 | 1.0 | Normal |
| 808 | 174 | 6.6 | 3.3 | 1.5 | 2.4 | 7.2 | 4.3 | Normal |
| 809 | 158 | 5.7 | 2.9 | 3.0 | 3.8 | 9.7 | 3.7 | Normal |
| 810 | 141 | 3.0 | 0.5 | 2.1 | 5.4 | 8.0 | 2.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 811 | 155 | 3.3 | 0.8 | 2.0 | 5.0 | 7.8 | 2.2 | Normal |
| 812 | 141 | 6.2 | 2.3 | 3.0 | 5.5 | 10.8 | 3.5 | Normal |
| 813 | 154 | 5.4 | 2.0 | 1.3 | 3.3 | 6.6 | 2.2 | Normal |
| 814 | 155 | 5.3 | 3.5 | 3.2 | 3.9 | 10.6 | 3.8 | Normal |
| 815 | 157 | 3.4 | 1.2 | 3.0 | 5.5 | 9.7 | 3.0 | Normal |
| 816 | 149 | 2.0 | 0.3 | 1.3 | 4.4 | 6.0 | 2.5 | Normal |
| 817 | 150 | 2.5 | 3.3 | 3.6 | 3.9 | 10.8 | 3.5 | Normal |
| 818 | 163 | 7.2 | 3.4 | 3.9 | 5.0 | 12.3 | 4.4 | Normal |
| 819 | 148 | 5.4 | 3.0 | 1.8 | 2.8 | 7.6 | 1.5 | Normal |
| 820 | 161 | 6.5 | 1.4 | 0.9 | 3.2 | 5.5 | 5.3 | Normal |
| 821 | 160 | 3.3 | 0.9 | 1.5 | 4.4 | 6.8 | 3.9 | Normal |
| 822 | 159 | 4.0 | 1.8 | 2.9 | 6.7 | 11.4 | 6.2 | Both Flat |
| 823 | 167 | 6.4 | 3.6 | 3.3 | 6.0 | 12.9 | 6.8 | Normal |
| 824 | 147 | 4.5 | 0.8 | 2.0 | 4.6 | 7.4 | 2.3 | Normal |
| 825 | 161 | 4.7 | 1.3 | 2.9 | 5.7 | 9.9 | 6.4 | Normal |
| 826 | 145 | 3.4 | 2.0 | 3.2 | 5.9 | 11.1 | 3.5 | Normal |
| 827 | 148 | 5.3 | 3.2 | 3.6 | 6.6 | 13.4 | 3.2 | Normal |
| 828 | 136 | 3.4 | 0.6 | 1.2 | 3.9 | 5.7 | 0.1 | Normal |
| 829 | 151 | 3.5 | 3.9 | 4.2 | 5.1 | 13.2 | 3.9 | Normal |
| 830 | 150 | 3.3 | 3.5 | 3.9 | 4.9 | 12.3 | 4.1 | Normal |
| 831 | 151 | 3.3 | 1.9 | 2.3 | 5.5 | 9.7 | 3.0 | Normal |
| 832 | 151 | 5.5 | 2.6 | 3.0 | 4.5 | 10.1 | 2.1 | Normal |
| 833 | 155 | 7.8 | 4.4 | 4.6 | 8.0 | 17.0 | 6.1 | Normal |
| 834 | 144 | 2.5 | 1.0 | 1.9 | 4.0 | 6.9 | 1.5 | Normal |
| 835 | 143 | 5.5 | 3.2 | 3.8 | 4.5 | 11.5 | 1.9 | 'L' |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 836 | 140 | 5.4 | 3.2 | 3.6 | 4.1 | 10.9 | 3.3 | Normal |
| 837 | 159 | 3.9 | 1.0 | 1.0 | 2.6 | 4.6 | 1.7 | Normal |
| 838 | 159 | 3.8 | 3.3 | 3.6 | 4.2 | 11.1 | 3.9 | Normal |
| 839 | 154 | 3.8 | 2.0 | 3.0 | 5.5 | 10.5 | 2.5 | Normal |
| 840 | 142 | 7.0 | 3.6 | 2.0 | 2.9 | 8.5 | 1.3 | Normal |
| 841 | 144 | 4.5 | 2.0 | 3.4 | 4.8 | 10.2 | 1.6 | Normal |
| 842 | 165 | 6.0 | 3.2 | 3.4 | 6.5 | 13.1 | 7.3 | Normal |
| 843 | 161 | 6.2 | 3.9 | 3.0 | 4.7 | 11.6 | 5.1 | Normal |
| 844 | 159 | 3.7 | 0.8 | 0.4 | 3.0 | 4.2 | 5.1 | Normal |
| 845 | 150 | 4.5 | 1.7 | 1.5 | 3.8 | 7.0 | 4.5 | Normal |
| 846 | 146 | 3.1 | 1.6 | 2.4 | 4.0 | 8.0 | 1.1 | Normal |
| 847 | 149 | 3.2 | 3.6 | 3.9 | 4.1 | 11.6 | 3.2 | Normal |
| 848 | 150 | 4.5 | 1.8 | 2.1 | 3.8 | 7.7 | 2.0 | Normal |
| 849 | 169 | 6.3 | 3.6 | 3.7 | 6.6 | 13.9 | 8.4 | Normal |
| 850 | 147 | 5.0 | 3.0 | 6.0 | 8.3 | 17.3 | 3.8 | Both Flat |
| 851 | 151 | 4.0 | 1.4 | 2.0 | 4.9 | 8.3 | 3.4 | Normal |
| 852 | 162 | 5.2 | 2.9 | 3.2 | 6.4 | 12.5 | 7.6 | Normal |
| 853 | 158 | 7.3 | 3.5 | 2.8 | 4.1 | 10.4 | 6.0 | Normal |
| 854 | 142 | 2.9 | 0.2 | 2.0 | 5.0 | 7.2 | 2.8 | Normal |
| 855 | 148 | 2.6 | 0.7 | 2.2 | 4.8 | 7.7 | 2.2 | Normal |
| 856 | 155 | 2.4 | 1.1 | 1.4 | 3.5 | 6.0 | 3.2 | Normal |
| 857 | 159 | 5.3 | 3.0 | 2.5 | 3.6 | 9.1 | 4.9 | Normal |
| 858 | 159 | 5.1 | 3.1 | 3.6 | 3.9 | 10.6 | 4.7 | Normal |
| 859 | 156 | 3.5 | 0.1 | 1.4 | 4.0 | 5.5 | 3.3 | Normal |
| 860 | 159 | 6.5 | 2.4 | 1.3 | 1.9 | 5.6 | 4.0 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 861 | 157 | 3.2 | 1.5 | 2.4 | 4.8 | 8.7 | 3.2 | Normal |
| 862 | 157 | 3.5 | 2.5 | 2.9 | 5.1 | 10.5 | 3.1 | Normal |
| 863 | 155 | 5.8 | 2.8 | 1.8 | 3.5 | 8.1 | 4.2 | Normal |
| 864 | 156 | 5.7 | 3.1 | 3.5 | 4.6 | 11.2 | 4.3 | Normal |
| 865 | 160 | 6.0 | 2.6 | 2.5 | 3.9 | 9.0 | 5.1 | Normal |
| 866 | 151 | 4.8 | 1.5 | 2.3 | 5.3 | 9.1 | 4.9 | Normal |
| 867 | 166 | 6.5 | 4.3 | 3.1 | 3.9 | 11.3 | 4.3 | Normal |
| 868 | 160 | 5.0 | 1.9 | 1.7 | 3.5 | 7.1 | 4.5 | Normal |
| 869 | 155 | 5.1 | 3.5 | 3.0 | 5.9 | 12.4 | 3.5 | Normal |
| 870 | 155 | 5.5 | 2.9 | 3.5 | 4.2 | 10.6 | 3.9 | Normal |
| 871 | 159 | 6.0 | 2.3 | 2.3 | 5.7 | 10.3 | 6.6 | Both Flat |
| 872 | 167 | 7.3 | 5.2 | 5.9 | 7.1 | 18.2 | 6.5 | Normal |
| 873 | 166 | 6.5 | 4.3 | 3.1 | 4.0 | 11.4 | 4.3 | Normal |
| 874 | 168 | 7.3 | 5.3 | 6.0 | 8.2 | 19.5 | 9.5 | Normal |
| 875 | 158 | 5.0 | 2.4 | 2.4 | 3.9 | 8.7 | 3.0 | Normal |
| 876 | 154 | 4.1 | 3.5 | 3.9 | 4.2 | 11.6 | 3.9 | Normal |
| 877 | 166 | 4.2 | 1.3 | 2.5 | 4.9 | 8.7 | 5.5 | Normal |
| 878 | 159 | 5.5 | 3.1 | 3.5 | 5.1 | 11.7 | 3.7 | Normal |
| 879 | 158 | 5.8 | 3.5 | 4.0 | 3.9 | 11.4 | 3.9 | Normal |
| 880 | 168 | 7.0 | 1.9 | 0.9 | 4.5 | 7.3 | 5.3 | Normal |
| 881 | 161 | 3.5 | 1.8 | 2.5 | 5.1 | 9.4 | 4.1 | Normal |
| 882 | 158 | 5.3 | 3.2 | 3.9 | 6.9 | 14.0 | 3.7 | Normal |
| 883 | 160 | 5.9 | 3.4 | 3.7 | 3.9 | 11.0 | 5.1 | Normal |
| 884 | 165 | 5.4 | 3.5 | 3.8 | 4.1 | 11.4 | 6.0 | Normal |
| 885 | 167 | 6.7 | 3.2 | 2.3 | 5.5 | 11.0 | 6.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 886 | 167 | 7.5 | 2.8 | 1.1 | 2.2 | 6.1 | 3.9 | Normal |
| 887 | 163 | 3.5 | 1.8 | 2.5 | 5.0 | 9.3 | 4.9 | Normal |
| 888 | 170 | 4.3 | 1.1 | 1.0 | 3.2 | 5.3 | 4.9 | Normal |
| 889 | 151 | 6.6 | 2.5 | 2.7 | 4.9 | 10.1 | 3.1 | Normal |
| 890 | 169 | 6.9 | 4.5 | 5.0 | 6.9 | 16.4 | 4.5 | Normal |
| 891 | 154 | 5.9 | 3.1 | 2.5 | 4.0 | 9.6 | 3.9 | Normal |
| 892 | 153 | 4.7 | 1.3 | 2.5 | 5.2 | 9.0 | 3.6 | Normal |
| 893 | 155 | 5.9 | 2.9 | 2.7 | 4.9 | 10.5 | 5.0 | Normal |
| 894 | 165 | 6.0 | 4.4 | 3.7 | 6.1 | 14.2 | 5.8 | Normal |
| 895 | 169 | 7.0 | 4.7 | 5.1 | 7.1 | 16.9 | 4.9 | Normal |
| 896 | 160 | 5.9 | 3.5 | 3.8 | 3.4 | 10.7 | 5.5 | Normal |
| 897 | 165 | 6.5 | 4.6 | 4.9 | 6.5 | 16.0 | 4.5 | Normal |
| 898 | 156 | 4.3 | 0.8 | 0.5 | 3.7 | 5.0 | 3.1 | Normal |
| 899 | 160 | 6.8 | 5.0 | 4.5 | 5.5 | 15.0 | 5.0 | Normal |
| 900 | 151 | 4.2 | 2.8 | 2.6 | 4.3 | 9.7 | 2.5 | Normal |
| 901 | 155 | 5.2 | 3.9 | 4.1 | 5.9 | 13.9 | 5.3 | Normal |
| 902 | 142 | 6.0 | 3.0 | 2.5 | 3.6 | 9.1 | 2.3 | Normal |
| 903 | 169 | 6.8 | 4.0 | 4.4 | 6.6 | 15.0 | 8.0 | Normal |
| 904 | 159 | 5.5 | 3.1 | 3.2 | 5.5 | 11.8 | 4.9 | Normal |
| 905 | 169 | 7.9 | 4.2 | 3.7 | 6.3 | 14.2 | 7.9 | Normal |
| 906 | 159 | 10.3 | 3.3 | 1.2 | 2.5 | 7.0 | 4.5 | Normal |
| 907 | 159 | 7.3 | 3.1 | 3.5 | 3.9 | 10.5 | 4.5 | Normal |
| 908 | 155 | 5.5 | 2.3 | 0.8 | 2.5 | 5.6 | 3.8 | Normal |
| 909 | 155 | 5.4 | 2.3 | 3.5 | 5.5 | 11.3 | 3.9 | Normal |
| 910 | 165 | 8.3 | 4.0 | 3.3 | 5.2 | 12.5 | 4.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 911 | 164 | 7.3 | 3.9 | 3.7 | 3.9 | 11.5 | 4.5 | Normal |
| 912 | 165 | 6.1 | 4.1 | 3.2 | 5.1 | 12.4 | 4.4 | Normal |
| 913 | 161 | 5.2 | 4.3 | 3.5 | 5.7 | 13.5 | 5.0 | Normal |
| 914 | 161 | 5.3 | 2.3 | 2.0 | 3.8 | 8.1 | 4.3 | Normal |
| 915 | 157 | 5.2 | 3.4 | 3.7 | 5.9 | 13.0 | 4.9 | Normal |
| 916 | 153 | 4.7 | 1.9 | 2.4 | 5.2 | 9.5 | 5.5 | Normal |
| 917 | 172 | 8.8 | 5.0 | 3.5 | 4.5 | 13.0 | 6.0 | Normal |
| 918 | 165 | 6.3 | 5.4 | 6.5 | 10.0 | 21.9 | 9.9 | Normal |
| 919 | 159 | 5.5 | 3.0 | 2.2 | 4.2 | 9.4 | 3.5 | Normal |
| 920 | 158 | 5.5 | 3.4 | 2.3 | 4.7 | 10.4 | 3.5 | Normal |
| 921 | 157 | 5.6 | 3.0 | 2.0 | 3.3 | 8.3 | 4.9 | 'L' |
| 922 | 153 | 6.6 | 2.0 | 2.2 | 4.8 | 9.0 | 2.8 | Normal |
| 923 | 162 | 6.5 | 4.3 | 3.6 | 5.9 | 13.8 | 5.1 | Normal |
| 924 | 168 | 8.6 | 2.7 | 3.0 | 5.8 | 11.5 | 7.3 | Normal |
| 925 | 167 | 7.9 | 3.9 | 3.1 | 5.7 | 12.7 | 7.1 | Normal |
| 926 | 166 | 5.5 | 3.2 | 3.8 | 5.3 | 12.3 | 6.6 | Normal |
| 927 | 157 | 6.2 | 3.2 | 3.9 | 6.7 | 13.8 | 4.0 | Normal |
| 928 | 158 | 6.0 | 3.5 | 3.8 | 5.5 | 12.8 | 4.1 | Normal |
| 929 | 150 | 4.4 | 3.2 | 3.7 | 5.5 | 12.4 | 2.6 | Normal |
| 930 | 155 | 4.4 | 1.2 | 2.1 | 4.8 | 8.1 | 3.8 | Normal |
| 931 | 158 | 8.4 | 3.7 | 1.5 | 3.3 | 8.5 | 3.5 | Normal |
| 932 | 170 | 4.2 | 1.3 | 2.0 | 4.6 | 7.9 | 5.5 | Normal |
| 933 | 162 | 4.3 | 2.0 | 1.5 | 3.4 | 6.9 | 5.8 | Normal |
| 934 | 164 | 4.9 | 3.2 | 3.8 | 5.8 | 12.8 | 4.0 | Normal |
| 935 | 161 | 8.5 | 4.9 | 5.3 | 7.8 | 18.0 | 6.5 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 936 | 166 | 5.0 | 2.0 | 2.3 | 3.6 | 7.9 | 2.7 | Normal |
| 937 | 164 | 4.8 | 2.4 | 2.5 | 5.1 | 10.0 | 6.1 | Normal |
| 938 | 143 | 6.9 | 4.4 | 5.8 | 8.3 | 18.5 | 6.9 | Normal |
| 939 | 151 | 6.1 | 3.8 | 2.8 | 5.1 | 11.7 | 4.8 | Normal |
| 940 | 159 | 5.9 | 2.8 | 1.9 | 3.8 | 8.5 | 4.9 | Normal |
| 941 | 169 | 8.0 | 5.4 | 4.5 | 5.8 | 15.7 | 5.0 | Normal |
| 942 | 160 | 7.9 | 3.8 | 3.6 | 4.1 | 11.5 | 5.3 | Normal |
| 943 | 160 | 6.8 | 5.0 | 4.5 | 5.5 | 15.0 | 5.5 | Normal |
| 944 | 163 | 7.8 | 3.8 | 2.5 | 3.9 | 10.2 | 5.2 | Normal |
| 945 | 170 | 5.9 | 3.6 | 3.7 | 4.4 | 11.7 | 6.0 | Normal |
| 946 | 153 | 5.5 | 2.9 | 2.4 | 4.5 | 9.8 | 4.6 | Normal |
| 947 | 162 | 5.0 | 3.4 | 3.2 | 5.4 | 12.0 | 5.4 | 'L' |
| 948 | 150 | 6.2 | 3.9 | 2.9 | 6.3 | 13.1 | 4.9 | Normal |
| 949 | 154 | 7.6 | 4.4 | 5.5 | 9.4 | 19.3 | 6.9 | Normal |
| 950 | 145 | 6.9 | 3.2 | 2.9 | 5.3 | 11.4 | 4.9 | Normal |
| 951 | 156 | 7.5 | 3.9 | 3.9 | 5.2 | 16.0 | 7.2 | Normal |
| 952 | 149 | 5.0 | 2.6 | 3.9 | 7.9 | 14.4 | 8.4 | Normal |
| 953 | 150 | 8.8 | 6.2 | 6.3 | 8.5 | 21.0 | 5.4 | Normal |
| 954 | 141 | 4.5 | 3.5 | 3.4 | 4.1 | 11.0 | 2.0 | Both Flat |
| 955 | 150 | 5.7 | 3.7 | 2.9 | 4.9 | 11.5 | 3.9 | Normal |
| 956 | 150 | 5.6 | 3.6 | 2.9 | 4.7 | 11.2 | 3.5 | Normal |
| 957 | 175 | 6.0 | 3.2 | 3.4 | 5.7 | 12.3 | 8.4 | Normal |
| 958 | 151 | 5.9 | 4.5 | 5.5 | 7.7 | 17.7 | 5.9 | Normal |
| 959 | 159 | 5.3 | 2.5 | 2.5 | 4.8 | 9.8 | 4.6 | Normal |
| 960 | 142 | 6.3 | 3.5 | 3.9 | 7.0 | 14.4 | 4.3 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 961 | 140 | 5.8 | 3.1 | 4.0 | 6.0 | 13.1 | 2.9 | Normal |
| 962 | 149 | 6.3 | 2.5 | 3.5 | 5.5 | 11.5 | 1.5 | Normal |
| 963 | 137 | 4.4 | 3.1 | 3.8 | 6.3 | 13.2 | 4.3 | Normal |
| 964 | 152 | 6.0 | 4.2 | 5.5 | 6.5 | 16.2 | 3.0 | Normal |
| 965 | 140 | 3.5 | 2.0 | 4.0 | 5.2 | 11.2 | 1.2 | Normal |
| 966 | 132 | 4.3 | 1.9 | 3.0 | 6.2 | 11.1 | 2.9 | Normal |
| 967 | 170 | 4.5 | 3.3 | 2.9 | 6.0 | 12.2 | 6.5 | Normal |
| 968 | 159 | 7.4 | 4.9 | 4.5 | 5.5 | 14.9 | 5.0 | Normal |
| 969 | 160 | 10.5 | 7.5 | 7.9 | 7.2 | 22.6 | 2.4 | Normal |
| 970 | 162 | 6.3 | 4.6 | 4.7 | 6.3 | 15.6 | 6.5 | Normal |
| 971 | 144 | 6.1 | 3.8 | 5.0 | 6.8 | 15.6 | 4.1 | Normal |
| 972 | 148 | 6.5 | 3.5 | 4.4 | 8.0 | 15.9 | 5.6 | Normal |
| 973 | 165 | 6.3 | 4.7 | 4.9 | 6.1 | 15.7 | 6.5 | Normal |
| 974 | 166 | 7.4 | 5.4 | 4.0 | 4.5 | 13.9 | 4.7 | Normal |
| 975 | 151 | 4.5 | 3.5 | 3.3 | 5.4 | 12.2 | 3.5 | Normal |
| 976 | 140 | 5.5 | 3.7 | 4.5 | 4.9 | 13.1 | 4.5 | Normal |
| 977 | 155 | 5.0 | 2.7 | 1.0 | 2.3 | 6.0 | 3.4 | Normal |
| 978 | 161 | 5.3 | 2.7 | 1.8 | 4.8 | 9.3 | 4.0 | Normal |
| 979 | 150 | 4.5 | 2.5 | 3.1 | 5.5 | 11.1 | 2.0 | Normal |
| 980 | 159 | 4.9 | 1.5 | 0.5 | 2.5 | 4.5 | 4.4 | Normal |
| 981 | 160 | 5.3 | 2.5 | 2.9 | 4.9 | 10.3 | 4.1 | Normal |
| 982 | 161 | 5.5 | 3.1 | 3.4 | 3.7 | 10.2 | 5.0 | Normal |
| 983 | 156 | 6.1 | 1.5 | 2.0 | 3.6 | 7.1 | 2.0 | Normal |
| 984 | 165 | 6.1 | 4.7 | 4.5 | 5.9 | 15.1 | 5.5 | Normal |
| 985 | 145 | 5.4 | 4.9 | 5.0 | 6.3 | 16.2 | 4.2 | Normal |

# APPENDIX – A (Continued)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 986 | 151 | 7.8 | 5.3 | 4.5 | 6.0 | 15.8 | 1.1 | 'L' |
| 987 | 163 | 5.5 | 3.2 | 2.9 | 4.0 | 10.1 | 5.1 | Normal |
| 988 | 158 | 9.3 | 3.6 | 3.4 | 6.0 | 13.0 | 4.5 | Normal |
| 989 | 150 | 7.8 | 5.0 | 4.4 | 5.1 | 14.5 | 3.2 | Normal |
| 990 | 155 | 4.5 | 3.0 | 4.1 | 5.8 | 12.9 | 3.4 | Normal |
| 991 | 156 | 4.8 | 2.8 | 4.3 | 6.7 | 13.8 | 4.5 | Normal |
| 992 | 147 | 6.0 | 4.8 | 5.0 | 7.0 | 16.8 | 5.0 | Normal |
| 993 | 158 | 5.0 | 1.9 | 1.7 | 3.4 | 7.0 | 4.1 | 'L' |
| 994 | 147 | 5.1 | 4.7 | 5.1 | 6.6 | 16.4 | 5.1 | Normal |
| 995 | 149 | 5.3 | 4.5 | 5.0 | 5.5 | 15.0 | 4.5 | Normal |
| 996 | 150 | 7.8 | 4.9 | 4.4 | 5.9 | 15.2 | 1.5 | Normal |
| 997 | 154 | 4.7 | 2.5 | 4.1 | 5.9 | 12.5 | 4.5 | Normal |
| 998 | 146 | 7.5 | 2.9 | 2.4 | 3.8 | 9.1 | 3.4 | Normal |
| 999 | 147 | 7.1 | 2.5 | 3.1 | 3.6 | 9.2 | 3.5 | Normal |
| 1000 | 140 | 5.6 | 4.1 | 4.8 | 7.1 | 16.0 | 3.4 | Normal |
| 1001 | 166 | 6.3 | 4.8 | 3.7 | 5.1 | 13.6 | 6.5 | Normal |
| 1002 | 145 | 4.5 | 1.7 | 3.5 | 4.1 | 9.3 | 3.5 | Normal |
| 1003 | 160 | 8.9 | 5.6 | 5.1 | 6.5 | 17.2 | 6.5 | Normal |
| 1004 | 147 | 5.1 | 3.2 | 3.6 | 3.9 | 7.7 | 4.2 | Normal |
| 1005 | 150 | 5.1 | 2.8 | 3.1 | 3.9 | 9.8 | 3.6 | Normal |
| 1006 | 150 | 5.2 | 2.8 | 2.9 | 4.0 | 9.5 | 2.3 | Normal |

# APPENDIX - B

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (131-135 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 02 | 5.5 | 10.6 | 2.0 |
| 02 | 19 | 8.2 | 20.7 | 7.0 |
| 03 | 32 | 6.4 | 17.2 | 4.5 |
| 04 | 52 | 6.3 | 15.5 | 3.5 |
| 05 | 59 | 4.0 | 13.7 | 1.9 |
| 06 | 68 | 3.2 | 9.9 | 3.9 |
| 07 | 89 | 5.5 | 5.8 | 0.5 |
| 08 | 91 | 5.4 | 12.9 | 3.5 |
| 09 | 92 | 5.5 | 13.1 | 4.1 |
| 10 | 93 | 5.2 | 12.1 | 5.0 |
| 11 | 101 | 6.2 | 22.5 | 5.0 |
| 12 | 102 | 5.0 | 11.0 | 5.0 |
| 13 | 117 | 5.4 | 13.5 | 4.5 |
| 14 | 122 | 6.3 | 15.5 | 3.5 |
| 15 | 125 | 5.3 | 8.4 | 1.0 |
| 16 | 206 | 5.2 | 14.7 | 3.1 |
| 17 | 207 | 6.2 | 21.4 | 4.5 |
| 18 | 223 | 5.4 | 11.9 | 4.9 |
| 19 | 446 | 5.0 | 13.5 | 4.1 |
| 20 | 503 | 5.5 | 12.0 | 3.5 |
| 21 | 538 | 4.5 | 11.7 | 3.9 |
| 22 | 634 | 5.5 | 12.9 | 3.9 |
| 23 | 656 | 6.0 | 4.1 | 2.1 |
| 24 | 966 | 4.3 | 11.1 | 2.9 |

# APPENDIX - C

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (136-140 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 03 | 7.0 | 23.5 | 7.3 |
| 02 | 08 | 8.4 | 19.5 | 2.0 |
| 03 | 24 | 7.9 | 18.4 | 6.5 |
| 04 | 26 | 7.5 | 11.6 | 6.6 |
| 05 | 27 | 8.3 | 13.6 | 4.6 |
| 06 | 31 | 7.0 | 15.8 | 3.6 |
| 07 | 33 | 8.0 | 23.4 | 7.0 |
| 08 | 53 | 6.5 | 12.0 | 4.9 |
| 09 | 54 | 2.5 | 8.3 | 2.5 |
| 10 | 56 | 3.5 | 15.0 | 6.5 |
| 11 | 72 | 5.4 | 11.5 | 2.3 |
| 12 | 73 | 8.0 | 11.1 | 0.5 |
| 13 | 83 | 5.0 | 10.6 | 3.1 |
| 14 | 94 | 5.6 | 16.8 | 3.5 |
| 15 | 96 | 5.5 | 8.9 | 2.0 |
| 16 | 100 | 5.6 | 15.1 | 2.5 |
| 17 | 103 | 6.0 | 3.9 | 0.5 |
| 18 | 107 | 3.0 | 11.5 | 1.0 |
| 19 | 119 | 5.6 | 16.9 | 3.3 |
| 20 | 168 | 5.7 | 11.3 | 3.4 |
| 21 | 179 | 4.9 | 5.9 | 2.5 |
| 22 | 191 | 5.8 | 13.1 | 4.3 |

# APPENDIX – C (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 23 | 273 | 7.0 | 22.0 | 7.1 |
| 24 | 274 | 5.5 | 10.6 | 3.6 |
| 25 | 317 | 5.0 | 6.3 | 3.7 |
| 26 | 420 | 5.2 | 11.2 | 3.5 |
| 27 | 444 | 5.5 | 14.4 | 3.5 |
| 28 | 445 | 5.2 | 11.9 | 5.0 |
| 29 | 498 | 5.4 | 12.0 | 2.0 |
| 30 | 500 | 5.3 | 14.3 | 4.7 |
| 31 | 502 | 4.5 | 12.8 | 4.7 |
| 32 | 539 | 4.7 | 12.6 | 3.7 |
| 33 | 541 | 5.5 | 12.9 | 4.6 |
| 34 | 543 | 5.0 | 13.7 | 4.2 |
| 35 | 574 | 3.9 | 6.9 | 3.9 |
| 36 | 575 | 5.5 | 13.7 | 4.6 |
| 37 | 580 | 5.6 | 14.1 | 4.3 |
| 38 | 589 | 5.7 | 12.1 | 2.6 |
| 39 | 638 | 5.4 | 12.6 | 2.3 |
| 40 | 639 | 4.6 | 13.1 | 4.6 |
| 41 | 649 | 5.0 | 13.1 | 2.6 |
| 42 | 652 | 5.5 | 12.5 | 4.0 |
| 43 | 655 | 5.2 | 14.9 | 3.7 |
| 44 | 755 | 5.5 | 13.9 | 3.6 |
| 45 | 772 | 4.5 | 15.0 | 4.7 |
| 46 | 790 | 5.7 | 10.8 | 2.4 |
| 47 | 828 | 3.4 | 5.7 | 0.1 |
| 48 | 836 | 5.4 | 10.9 | 3.3 |

# APPENDIX – C (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 49 | 961 | 5.8 | 13.1 | 2.9 |
| 50 | 963 | 4.4 | 13.2 | 4.3 |
| 51 | 965 | 3.5 | 11.2 | 1.2 |
| 52 | 976 | 5.5 | 13.1 | 4.5 |
| 53 | 1000 | 5.6 | 16.0 | 3.4 |

# APPENDIX - D

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (141-145 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 01 | 8.5 | 17.9 | 4.5 |
| 02 | 04 | 7.2 | 18.2 | 5.3 |
| 03 | 10 | 4.6 | 11.9 | 5.3 |
| 04 | 14 | 5.0 | 15.2 | 4.9 |
| 05 | 15 | 5.1 | 14.2 | 4.1 |
| 06 | 16 | 8.0 | 17.1 | 4.4 |
| 07 | 17 | 6.9 | 13.3 | 3.0 |
| 08 | 21 | 3.9 | 22.9 | 6.8 |
| 09 | 28 | 6.2 | 13.6 | 5.5 |
| 10 | 29 | 6.2 | 13.4 | 5.0 |
| 11 | 76 | 4.4 | 8.4 | 2.0 |
| 12 | 85 | 5.0 | 11.6 | 2.5 |
| 13 | 86 | 5.1 | 13.6 | 3.5 |
| 14 | 87 | 5.1 | 15.2 | 3.2 |
| 15 | 88 | 5.5 | 11.0 | 4.9 |
| 16 | 104 | 6.4 | 11.3 | 2.5 |
| 17 | 108 | 5.5 | 10.5 | 5.1 |
| 18 | 110 | 5.0 | 14.6 | 3.0 |
| 19 | 118 | 6.0 | 14.2 | 1.5 |
| 20 | 121 | 5.2 | 7.5 | 1.0 |
| 21 | 124 | 6.5 | 12.1 | 3.0 |
| 22 | 134 | 3.2 | 4.9 | 2.5 |
| 23 | 135 | 5.7 | 15.2 | 5.7 |
| 24 | 136 | 5.6 | 14.7 | 5.5 |

# APPENDIX – D (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 25 | 137 | 5.7 | 9.7 | 1.0 |
| 26 | 146 | 6.4 | 10.1 | 3.3 |
| 27 | 187 | 5.2 | 12.1 | 2.9 |
| 28 | 193 | 5.2 | 15.0 | 5.7 |
| 29 | 202 | 6.1 | 14.6 | 4.5 |
| 30 | 203 | 4.4 | 8.3 | 3.5 |
| 31 | 312 | 6.1 | 12.7 | 4.5 |
| 32 | 315 | 5.1 | 12.7 | 4.5 |
| 33 | 325 | 5.4 | 10.7 | 2.1 |
| 34 | 354 | 4.4 | 8.2 | 4.5 |
| 35 | 355 | 6.1 | 14.1 | 3.5 |
| 36 | 367 | 5.5 | 12.3 | 3.5 |
| 37 | 372 | 5.2 | 12.2 | 3.0 |
| 38 | 383 | 5.0 | 15.5 | 3.0 |
| 39 | 418 | 4.1 | 8.7 | 3.0 |
| 40 | 448 | 5.1 | 11.0 | 5.1 |
| 41 | 462 | 3.5 | 5.8 | 2.9 |
| 42 | 479 | 5.0 | 14.3 | 6.0 |
| 43 | 489 | 4.9 | 9.3 | 2.7 |
| 44 | 492 | 5.1 | 11.8 | 4.5 |
| 45 | 497 | 4.5 | 12.4 | 2.7 |
| 46 | 529 | 4.4 | 11.3 | 3.7 |
| 47 | 544 | 5.2 | 12.7 | 4.3 |
| 48 | 549 | 4.5 | 12.0 | 2.4 |
| 49 | 553 | 5.2 | 11.4 | 5.0 |
| 50 | 562 | 5.7 | 12.8 | 4.5 |
| 51 | 570 | 5.2 | 7.9 | 3.5 |
| 52 | 573 | 5.3 | 12.3 | 2.5 |

# APPENDIX – D (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 53 | 576 | 5.0 | 12.2 | 4.9 |
| 54 | 577 | 5.7 | 12.2 | 3.8 |
| 55 | 579 | 5.2 | 12.8 | 3.5 |
| 56 | 584 | 5.0 | 11.7 | 4.9 |
| 57 | 590 | 5.5 | 11.1 | 2.3 |
| 58 | 610 | 4.7 | 11.9 | 4.5 |
| 59 | 615 | 4.5 | 12.7 | 4.7 |
| 60 | 619 | 6.0 | 11.1 | 4.1 |
| 61 | 641 | 5.5 | 13.0 | 3.5 |
| 62 | 642 | 4.4 | 8.9 | 2.1 |
| 63 | 645 | 5.5 | 14.0 | 3.0 |
| 64 | 650 | 5.1 | 14.2 | 3.2 |
| 65 | 651 | 5.5 | 6.4 | 2.9 |
| 66 | 654 | 5.1 | 11.2 | 3.5 |
| 67 | 697 | 5.5 | 16.2 | 2.9 |
| 68 | 720 | 5.5 | 15.8 | 2.0 |
| 69 | 758 | 4.9 | 9.2 | 2.8 |
| 70 | 767 | 4.4 | 10.5 | 4.0 |
| 71 | 776 | 6.4 | 9.4 | 2.3 |
| 72 | 786 | 5.0 | 11.4 | 2.8 |
| 73 | 791 | 5.5 | 10.8 | 1.4 |
| 74 | 793 | 5.0 | 13.2 | 4.0 |
| 75 | 810 | 3.0 | 8.0 | 2.5 |
| 76 | 812 | 6.2 | 10.8 | 3.5 |
| 77 | 826 | 3.4 | 11.1 | 3.5 |
| 78 | 834 | 2.5 | 6.9 | 1.5 |

# APPENDIX – D (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 79 | 835 | 5.5 | 9.9 | 1.9 |
| 80 | 840 | 7.0 | 8.5 | 1.3 |
| 81 | 841 | 4.5 | 10.2 | 1.6 |
| 82 | 854 | 2.9 | 7.2 | 2.8 |
| 83 | 902 | 6.0 | 9.1 | 2.3 |
| 84 | 938 | 6.9 | 18.5 | 6.9 |
| 85 | 950 | 6.9 | 11.4 | 4.9 |
| 86 | 954 | 4.5 | 11.0 | 2.0 |
| 87 | 960 | 6.3 | 14.4 | 4.3 |
| 88 | 971 | 6.1 | 15.6 | 4.1 |
| 89 | 985 | 5.4 | 15.8 | 4.2 |
| 90 | 1002 | 4.5 | 9.3 | 3.5 |

# APPENDIX - E

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (146-150 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 05 | 4.8 | 14.7 | 5.7 |
| 02 | 09 | 4.9 | 13.9 | 2.0 |
| 03 | 13 | 3.3 | 13.7 | 3.0 |
| 04 | 20 | 7.5 | 20.9 | 8.8 |
| 05 | 22 | 6.3 | 9.2 | 4.0 |
| 06 | 23 | 6.0 | 11.5 | 4.0 |
| 07 | 36 | 5.6 | 13.7 | 3.0 |
| 08 | 37 | 3.9 | 11.6 | 3.3 |
| 09 | 44 | 4.0 | 8.3 | 3.7 |
| 10 | 45 | 4.1 | 12.4 | 4.5 |
| 11 | 46 | 4.1 | 13.1 | 4.1 |
| 12 | 50 | 5.3 | 6.5 | 2.3 |
| 13 | 55 | 3.8 | 5.9 | 1.9 |
| 14 | 58 | 5.3 | 9.3 | 3.1 |
| 15 | 60 | 3.8 | 10.1 | 2.5 |
| 16 | 61 | 4.4 | 6.3 | 2.0 |
| 17 | 62 | 4.8 | 6.3 | 2.2 |
| 18 | 63 | 3.4 | 5.1 | 3.0 |
| 19 | 64 | 4.6 | 13.0 | 2.5 |
| 20 | 65 | 5.6 | 15.3 | 3.9 |
| 21 | 66 | 4.8 | 17.9 | 4.5 |
| 22 | 67 | 3.9 | 8.6 | 4.4 |
| 23 | 69 | 4.9 | 8.6 | 3.2 |
| 24 | 74 | 5.0 | 12.0 | 3.8 |

# APPENDIX – E (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 25 | 75 | 6.5 | 16.0 | 3.5 |
| 26 | 77 | 4.0 | 8.6 | 5.7 |
| 27 | 78 | 4.8 | 13.6 | 2.0 |
| 28 | 79 | 6.5 | 14.2 | 3.0 |
| 29 | 81 | 5.8 | 12.3 | 4.0 |
| 30 | 84 | 5.5 | 14.0 | 5.5 |
| 31 | 95 | 6.6 | 12.4 | 3.4 |
| 32 | 98 | 5.9 | 11.9 | 4.1 |
| 33 | 99 | 5.8 | 12.9 | 2.5 |
| 34 | 105 | 4.0 | 12.8 | 3.9 |
| 35 | 109 | 4.9 | 12.9 | 3.5 |
| 36 | 112 | 6.5 | 11.5 | 2.0 |
| 37 | 116 | 6.0 | 5.7 | 3.5 |
| 38 | 120 | 4.5 | 18.9 | 1.6 |
| 39 | 128 | 3.6 | 4.7 | 2.5 |
| 40 | 131 | 4.5 | 9.3 | 3.4 |
| 41 | 241 | 6.4 | 10.0 | 3.5 |
| 42 | 260 | 6.0 | 13.1 | 3.1 |
| 43 | 263 | 6.0 | 14.0 | 6.1 |
| 44 | 264 | 7.0 | 9.9 | 4.5 |
| 45 | 270 | 5.5 | 13.9 | 3.2 |
| 46 | 272 | 5.5 | 13.5 | 4.6 |
| 47 | 275 | 5.3 | 11.5 | 3.3 |
| 48 | 276 | 4.4 | 11.9 | 4.0 |
| 49 | 277 | 5.0 | 5.9 | 4.1 |
| 50 | 278 | 4.9 | 15.4 | 2.0 |
| 51 | 290 | 6.9 | 9.2 | 3.5 |
| 52 | 291 | 5.0 | 9.8 | 4.9 |

# APPENDIX – E (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 53 | 294 | 7.1 | 15.6 | 2.9 |
| 54 | 295 | 5.1 | 13.5 | 5.1 |
| 55 | 296 | 5.0 | 15.5 | 4.9 |
| 56 | 298 | 5.9 | 15.0 | 4.7 |
| 57 | 313 | 5.8 | 13.1 | 3.9 |
| 58 | 321 | 6.0 | 13.0 | 3.7 |
| 59 | 324 | 4.9 | 9.5 | 3.6 |
| 60 | 331 | 5.3 | 6.1 | 2.9 |
| 61 | 339 | 3.5 | 6.4 | 3.5 |
| 62 | 340 | 3.9 | 11.2 | 4.5 |
| 63 | 342 | 5.4 | 8.2 | 2.9 |
| 64 | 346 | 4.9 | 9.2 | 6.5 |
| 65 | 348 | 3.5 | 11.3 | 3.5 |
| 66 | 349 | 5.2 | 13.4 | 3.3 |
| 67 | 351 | 4.9 | 9.1 | 5.1 |
| 68 | 364 | 5.5 | 14.8 | 5.6 |
| 69 | 378 | 5.9 | 16.6 | 3.9 |
| 70 | 391 | 3.8 | 8.6 | 2.0 |
| 71 | 395 | 4.1 | 5.8 | 4.0 |
| 72 | 397 | 4.2 | 5.5 | 1.9 |
| 73 | 423 | 4.5 | 6.2 | 2.7 |
| 74 | 425 | 5.5 | 8.2 | 3.5 |
| 75 | 430 | 4.9 | 7.1 | 3.1 |
| 76 | 432 | 4.9 | 12.5 | 3.9 |
| 77 | 434 | 4.7 | 13.3 | 3.4 |
| 78 | 437 | 4.5 | 11.9 | 3.4 |
| 79 | 449 | 5.3 | 13.1 | 5.5 |
| 80 | 451 | 5.7 | 12.1 | 4.2 |

# APPENDIX – E (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 81 | 452 | 4.9 | 10.6 | 2.7 |
| 82 | 453 | 5.2 | 11.7 | 3.7 |
| 83 | 456 | 5.0 | 10.4 | 3.8 |
| 84 | 457 | 4.9 | 15.3 | 3.5 |
| 85 | 459 | 6.6 | 12.6 | 3.5 |
| 86 | 493 | 5.0 | 11.8 | 4.5 |
| 87 | 499 | 5.5 | 10.1 | 2.3 |
| 88 | 508 | 4.1 | 13.0 | 3.1 |
| 89 | 521 | 4.7 | 14.7 | 3.5 |
| 90 | 526 | 5.8 | 14.3 | 3.7 |
| 91 | 531 | 5.0 | 11.7 | 3.5 |
| 92 | 542 | 6.0 | 11.4 | 2.9 |
| 93 | 548 | 5.1 | 12.6 | 4.0 |
| 94 | 550 | 6.0 | 13.0 | 3.0 |
| 95 | 551 | 5.1 | 12.1 | 3.5 |
| 96 | 555 | 5.3 | 11.5 | 5.1 |
| 97 | 567 | 5.7 | 12.3 | 5.1 |
| 98 | 568 | 4.7 | 11.3 | 4.5 |
| 99 | 581 | 4.3 | 11.6 | 4.2 |
| 100 | 583 | 5.1 | 11.7 | 3.9 |
| 101 | 586 | 5.0 | 11.7 | 3.8 |
| 102 | 591 | 4.6 | 11.1 | 3.5 |
| 103 | 599 | 5.5 | 12.6 | 3.6 |
| 104 | 602 | 4.9 | 11.2 | 3.0 |
| 105 | 605 | 5.1 | 12.1 | 3.5 |
| 106 | 618 | 4.0 | 6.0 | 3.5 |
| 107 | 624 | 6.1 | 12.9 | 3.1 |
| 108 | 630 | 5.6 | 11.4 | 2.5 |

# APPENDIX – E (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 109 | 631 | 5.6 | 11.9 | 5.0 |
| 110 | 632 | 4.7 | 11.9 | 4.5 |
| 111 | 640 | 5.0 | 12.0 | 3.8 |
| 112 | 643 | 5.0 | 11.6 | 5.5 |
| 113 | 644 | 5.0 | 13.0 | 2.0 |
| 114 | 646 | 5.8 | 12.8 | 4.1 |
| 115 | 659 | 5.1 | 11.0 | 3.0 |
| 116 | 696 | 8.7 | 12.2 | 5.7 |
| 117 | 707 | 6.8 | 16.7 | 2.5 |
| 118 | 732 | 3.8 | 8.5 | 2.0 |
| 119 | 738 | 4.0 | 5.9 | 4.0 |
| 120 | 740 | 4.1 | 5.3 | 1.9 |
| 121 | 750 | 4.9 | 16.3 | 6.6 |
| 122 | 752 | 5.9 | 16.5 | 3.8 |
| 123 | 762 | 5.9 | 13.0 | 2.2 |
| 124 | 775 | 4.0 | 4.7 | 3.0 |
| 125 | 783 | 5.1 | 12.5 | 3.0 |
| 126 | 792 | 4.0 | 7.9 | 1.9 |
| 127 | 795 | 6.3 | 12.3 | 2.7 |
| 128 | 803 | 5.2 | 5.5 | 2.0 |
| 129 | 806 | 2.7 | 8.2 | 3.0 |
| 130 | 816 | 2.0 | 6.0 | 2.5 |
| 131 | 817 | 2.5 | 10.8 | 3.5 |
| 132 | 819 | 5.4 | 7.6 | 1.5 |
| 133 | 824 | 4.5 | 11.7 | 2.3 |
| 134 | 827 | 5.3 | 13.4 | 3.2 |

# APPENDIX – E (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 135 | 830 | 3.3 | 12.3 | 4.1 |
| 136 | 845 | 4.5 | 7.0 | 4.5 |
| 137 | 846 | 3.1 | 8.0 | 1.1 |
| 138 | 847 | 3.2 | 11.6 | 3.2 |
| 139 | 848 | 4.5 | 7.7 | 2.0 |
| 140 | 850 | 5.0 | 17.3 | 3.8 |
| 141 | 855 | 2.6 | 7.7 | 2.2 |
| 142 | 929 | 4.4 | 12.4 | 2.6 |
| 143 | 948 | 6.2 | 13.1 | 4.9 |
| 144 | 952 | 5.0 | 14.4 | 8.4 |
| 145 | 953 | 8.8 | 21.0 | 5.4 |
| 146 | 955 | 5.7 | 11.5 | 3.9 |
| 147 | 956 | 5.6 | 11.2 | 3.5 |
| 148 | 962 | 6.3 | 11.5 | 1.5 |
| 149 | 972 | 6.5 | 11.6 | 5.0 |
| 150 | 979 | 4.5 | 12.1 | 4.0 |
| 151 | 989 | 7.8 | 14.5 | 3.2 |
| 152 | 992 | 6.0 | 11.3 | 5.0 |
| 153 | 994 | 5.1 | 16.4 | 5.1 |
| 154 | 995 | 5.3 | 15.0 | 4.5 |
| 155 | 996 | 7.8 | 15.2 | 1.5 |
| 156 | 998 | 7.5 | 10.4 | 3.4 |
| 157 | 999 | 7.1 | 9.2 | 3.5 |
| 158 | 1004 | 5.1 | 10.7 | 4.2 |
| 159 | 1005 | 5.1 | 9.8 | 3.6 |
| 160 | 1006 | 5.2 | 9.7 | 2.3 |

# APPENDIX - F

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (151-155 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 06 | 4.5 | 7.0 | 3.3 |
| 02 | 07 | 11.0 | 18.4 | 5.7 |
| 03 | 11 | 6.9 | 14.9 | 6.1 |
| 04 | 39 | 5.3 | 10.6 | 5.0 |
| 05 | 51 | 4.1 | 9.6 | 3.5 |
| 06 | 57 | 4.3 | 13.0 | 3.5 |
| 07 | 70 | 5.2 | 10.0 | 4.9 |
| 08 | 71 | 5.3 | 10.8 | 2.5 |
| 09 | 90 | 5.5 | 18.4 | 5.5 |
| 10 | 102 | 6.6 | 11.9 | 4.0 |
| 11 | 106 | 5.3 | 8.8 | 2.3 |
| 12 | 111 | 5.3 | 11.1 | 3.5 |
| 13 | 114 | 6.3 | 17.0 | 1.1 |
| 14 | 115 | 5.1 | 10.1 | 3.0 |
| 15 | 123 | 7.0 | 13.2 | 2.8 |
| 16 | 126 | 5.1 | 13.1 | 2.6 |
| 17 | 130 | 5.3 | 11.4 | 2.3 |
| 18 | 132 | 4.0 | 9.7 | 3.0 |
| 19 | 138 | 4.5 | 7.8 | 4.0 |
| 20 | 159 | 5.5 | 6.6 | 3.9 |
| 21 | 180 | 5.2 | 14.7 | 5.3 |
| 22 | 184 | 4.5 | 12.5 | 2.8 |
| 23 | 199 | 5.5 | 12.7 | 3.6 |
| 24 | 212 | 5.0 | 10.5 | 5.5 |
| 25 | 221 | 8.0 | 19.0 | 6.9 |
| 26 | 226 | 8.0 | 16.6 | 4.5 |

# APPENDIX – F (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 27 | 227 | 7.9 | 18.6 | 6.5 |
| 28 | 233 | 5.5 | 8.9 | 4.0 |
| 29 | 253 | 5.0 | 11.0 | 4.5 |
| 30 | 257 | 5.5 | 9.6 | 3.7 |
| 31 | 262 | 5.0 | 8.8 | 3.8 |
| 32 | 266 | 4.5 | 12.0 | 4.5 |
| 33 | 267 | 4.5 | 13.3 | 3.7 |
| 34 | 269 | 6.8 | 14.4 | 1.9 |
| 35 | 279 | 4.5 | 11.7 | 4.6 |
| 36 | 280 | 5.1 | 13.7 | 5.1 |
| 37 | 293 | 4.6 | 12.0 | 4.5 |
| 38 | 300 | 4.7 | 13.0 | 3.5 |
| 39 | 305 | 4.9 | 6.8 | 4.1 |
| 40 | 314 | 5.5 | 12.8 | 5.3 |
| 41 | 329 | 3.9 | 4.0 | 3.5 |
| 42 | 330 | 5.2 | 10.7 | 4.1 |
| 43 | 358 | 5.5 | 12.5 | 3.5 |
| 44 | 371 | 4.8 | 13.0 | 4.5 |
| 45 | 375 | 4.5 | 11.7 | 3.5 |
| 46 | 377 | 3.0 | 9.0 | 4.5 |
| 47 | 380 | 5.5 | 10.7 | 5.0 |
| 48 | 384 | 5.2 | 12.2 | 4.5 |
| 49 | 386 | 4.5 | 14.3 | 6.0 |
| 50 | 388 | 5.0 | 10.1 | 5.4 |
| 51 | 398 | 4.5 | 4.9 | 3.0 |
| 52 | 400 | 5.6 | 7.7 | 5.0 |
| 53 | 412 | 5.2 | 5.7 | 2.5 |
| 54 | 413 | 5.2 | 10.7 | 3.9 |

# APPENDIX – F (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 55 | 414 | 4.1 | 5.1 | 2.9 |
| 56 | 421 | 5.6 | 11.3 | 3.9 |
| 57 | 439 | 5.3 | 10.7 | 5.3 |
| 58 | 447 | 5.6 | 13.9 | 4.7 |
| 59 | 454 | 5.4 | 11.6 | 3.3 |
| 60 | 455 | 5.3 | 10.1 | 2.5 |
| 61 | 458 | 6.5 | 12.1 | 4.1 |
| 62 | 460 | 6.3 | 12.6 | 4.5 |
| 63 | 485 | 4.9 | 9.4 | 5.0 |
| 64 | 487 | 5.3 | 11.7 | 4.0 |
| 65 | 488 | 5.4 | 11.7 | 4.3 |
| 66 | 490 | 5.5 | 5.8 | 3.8 |
| 67 | 495 | 5.5 | 12.1 | 4.0 |
| 68 | 501 | 4.9 | 10.2 | 5.3 |
| 69 | 509 | 5.4 | 10.1 | 4.3 |
| 70 | 515 | 5.3 | 12.3 | 4.1 |
| 71 | 525 | 4.6 | 9.4 | 4.0 |
| 72 | 528 | 5.3 | 5.2 | 3.5 |
| 73 | 540 | 6.3 | 13.2 | 3.6 |
| 74 | 546 | 5.3 | 13.1 | 5.0 |
| 75 | 552 | 6.5 | 12.6 | 4.1 |
| 76 | 554 | 6.1 | 11.8 | 5.4 |
| 77 | 557 | 5.3 | 6.8 | 3.9 |
| 78 | 571 | 5.4 | 10.4 | 4.7 |
| 79 | 572 | 5.5 | 11.4 | 4.6 |
| 80 | 582 | 5.5 | 11.7 | 4.0 |
| 81 | 592 | 5.0 | 12.2 | 3.7 |
| 82 | 594 | 6.3 | 11.9 | 3.3 |

# APPENDIX – F (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 83 | 604 | 5.3 | 13.5 | 5.0 |
| 84 | 620 | 5.2 | 11.8 | 5.0 |
| 85 | 622 | 5.0 | 11.1 | 4.4 |
| 86 | 623 | 4.9 | 10.6 | 3.9 |
| 87 | 633 | 5.3 | 7.6 | 4.4 |
| 88 | 635 | 5.0 | 11.7 | 4.2 |
| 89 | 636 | 5.2 | 10.3 | 4.5 |
| 90 | 637 | 5.3 | 11.1 | 3.5 |
| 91 | 648 | 5.0 | 10.9 | 3.3 |
| 92 | 652 | 5.5 | 11.0 | 5.0 |
| 93 | 657 | 4.3 | 9.8 | 4.0 |
| 94 | 658 | 5.3 | 11.0 | 3.5 |
| 95 | 663 | 4.9 | 10.1 | 5.5 |
| 96 | 668 | 6.5 | 9.3 | 3.0 |
| 97 | 673 | 4.5 | 12.4 | 2.7 |
| 98 | 684 | 9.0 | 16.5 | 4.6 |
| 99 | 688 | 4.8 | 9.1 | 4.9 |
| 100 | 701 | 10.0 | 17.6 | 4.3 |
| 101 | 713 | 6.5 | 12.3 | 4.1 |
| 102 | 719 | 5.6 | 7.6 | 5.0 |
| 103 | 721 | 6.2 | 12.3 | 4.6 |
| 104 | 722 | 6.1 | 11.9 | 4.1 |
| 105 | 726 | 4.1 | 13.0 | 5.1 |
| 106 | 728 | 5.0 | 10.3 | 5.3 |
| 107 | 737 | 4.5 | 11.1 | 6.5 |
| 108 | 741 | 3.1 | 4.8 | 3.0 |
| 109 | 743 | 5.8 | 7.5 | 5.0 |
| 110 | 744 | 5.8 | 10.5 | 4.5 |

# APPENDIX – F (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 111 | 751 | 3.0 | 9.0 | 4.0 |
| 112 | 754 | 5.5 | 10.6 | 5.0 |
| 113 | 761 | 5.3 | 13.2 | 5.1 |
| 114 | 774 | 4.2 | 9.6 | 2.1 |
| 115 | 777 | 5.1 | 13.6 | 4.5 |
| 116 | 778 | 5.2 | 16.5 | 4.0 |
| 117 | 781 | 5.9 | 10.2 | 5.3 |
| 118 | 782 | 4.8 | 8.4 | 3.6 |
| 119 | 804 | 5.1 | 10.5 | 3.9 |
| 120 | 805 | 3.7 | 4.2 | 2.4 |
| 121 | 811 | 3.3 | 7.8 | 2.2 |
| 122 | 813 | 5.4 | 6.6 | 2.2 |
| 123 | 814 | 5.3 | 10.6 | 3.8 |
| 124 | 829 | 3.5 | 13.2 | 3.9 |
| 125 | 831 | 3.3 | 9.7 | 3.0 |
| 126 | 832 | 5.5 | 10.1 | 2.1 |
| 127 | 833 | 5.8 | 10.6 | 5.1 |
| 128 | 839 | 3.8 | 10.5 | 2.5 |
| 129 | 851 | 4.3 | 10.9 | 3.4 |
| 130 | 856 | 2.4 | 6.0 | 3.2 |
| 131 | 863 | 5.8 | 8.1 | 4.2 |
| 132 | 866 | 4.8 | 9.1 | 4.9 |
| 133 | 869 | 5.1 | 12.4 | 3.5 |
| 134 | 870 | 5.5 | 10.6 | 3.9 |
| 135 | 876 | 4.1 | 11.6 | 3.9 |
| 136 | 889 | 6.6 | 10.1 | 3.1 |
| 137 | 891 | 5.9 | 9.6 | 3.9 |
| 138 | 892 | 4.7 | 9.0 | 3.6 |

# APPENDIX – F (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 139 | 893 | 5.9 | 10.5 | 5.0 |
| 140 | 900 | 4.2 | 9.7 | 2.5 |
| 141 | 901 | 5.2 | 13.9 | 5.3 |
| 142 | 908 | 5.5 | 5.5 | 3.8 |
| 143 | 909 | 5.4 | 11.3 | 3.9 |
| 144 | 916 | 4.7 | 9.5 | 5.5 |
| 145 | 922 | 6.6 | 9.0 | 2.8 |
| 146 | 930 | 4.4 | 8.2 | 3.8 |
| 147 | 939 | 6.1 | 11.7 | 4.8 |
| 148 | 946 | 5.5 | 9.8 | 4.6 |
| 149 | 949 | 7.6 | 19.3 | 6.9 |
| 150 | 958 | 5.9 | 17.7 | 5.9 |
| 151 | 964 | 6.0 | 13.1 | 3.8 |
| 152 | 975 | 4.5 | 12.2 | 3.5 |
| 153 | 977 | 5.0 | 6.0 | 3.4 |
| 154 | 986 | 7.8 | 15.8 | 1.1 |
| 155 | 990 | 4.5 | 12.9 | 3.4 |
| 156 | 997 | 4.7 | 12.5 | 4.5 |

# APPENDIX - G

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (156-160 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 12 | 7.7 | 13.6 | 6.1 |
| 02 | 18 | 7.4 | 13.9 | 7.0 |
| 03 | 30 | 8.0 | 15.1 | 6.6 |
| 04 | 34 | 6.5 | 10.0 | 4.9 |
| 05 | 35 | 4.0 | 14.5 | 3.9 |
| 06 | 38 | 5.3 | 5.6 | 5.0 |
| 07 | 41 | 6.6 | 11.5 | 3.5 |
| 08 | 43 | 4.0 | 6.1 | 3.4 |
| 09 | 47 | 3.5 | 11.3 | 3.3 |
| 10 | 48 | 3.0 | 4.1 | 2.9 |
| 11 | 80 | 5.8 | 8.9 | 2.4 |
| 12 | 82 | 5.7 | 11.1 | 3.6 |
| 13 | 127 | 6.5 | 11.3 | 5.5 |
| 14 | 129 | 6.1 | 10.0 | 5.8 |
| 15 | 133 | 4.4 | 4.9 | 4.4 |
| 16 | 142 | 5.7 | 12.5 | 5.7 |
| 17 | 148 | 4.9 | 11.8 | 4.1 |
| 18 | 149 | 5.5 | 10.4 | 6.5 |
| 19 | 150 | 5.5 | 12.6 | 3.9 |
| 20 | 151 | 5.5 | 9.0 | 3.5 |
| 21 | 152 | 5.3 | 11.5 | 3.9 |
| 22 | 155 | 5.9 | 9.9 | 3.5 |
| 23 | 157 | 5.5 | 10.0 | 4.9 |
| 24 | 158 | 5.6 | 4.2 | 3.5 |
| 25 | 160 | 5.9 | 10.4 | 4.4 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 26 | 161 | 5.3 | 12.8 | 5.7 |
| 27 | 165 | 5.0 | 12.6 | 4.5 |
| 28 | 167 | 8.4 | 12.9 | 6.0 |
| 29 | 172 | 9.3 | 13.1 | 4.5 |
| 30 | 173 | 4.5 | 9.1 | 7.0 |
| 31 | 183 | 4.5 | 8.3 | 3.8 |
| 32 | 185 | 6.5 | 15.3 | 8.4 |
| 33 | 188 | 5.5 | 11.5 | 5.2 |
| 34 | 189 | 4.8 | 14.5 | 3.5 |
| 35 | 192 | 6.5 | 9.9 | 4.4 |
| 36 | 198 | 5.5 | 7.1 | 4.5 |
| 37 | 211 | 6.0 | 3.8 | 3.5 |
| 38 | 220 | 5.5 | 12.3 | 4.0 |
| 39 | 222 | 6.0 | 8.3 | 5.5 |
| 40 | 229 | 8.5 | 11.9 | 4.0 |
| 41 | 231 | 5.0 | 10.7 | 5.7 |
| 42 | 232 | 5.3 | 6.4 | 3.5 |
| 43 | 237 | 5.7 | 12.3 | 5.7 |
| 44 | 243 | 5.0 | 12.1 | 4.5 |
| 45 | 244 | 5.5 | 10.2 | 6.1 |
| 46 | 245 | 5.5 | 12.6 | 4.1 |
| 47 | 248 | 5.9 | 11.5 | 4.5 |
| 48 | 250 | 5.5 | 10.5 | 5.0 |
| 49 | 251 | 5.6 | 4.0 | 3.5 |
| 50 | 252 | 5.5 | 6.7 | 4.1 |
| 51 | 281 | 5.3 | 8.4 | 2.9 |
| 52 | 282 | 5.6 | 10.4 | 3.2 |
| 53 | 292 | 5.2 | 10.1 | 5.0 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 54 | 297 | 5.2 | 9.9 | 5.0 |
| 55 | 299 | 4.9 | 13.4 | 4.5 |
| 56 | 301 | 4.9 | 10.8 | 4.3 |
| 57 | 307 | 5.7 | 5.0 | 3.5 |
| 58 | 308 | 6.0 | 10.4 | 3.9 |
| 59 | 311 | 5.3 | 10.1 | 4.6 |
| 60 | 328 | 5.1 | 9.6 | 3.7 |
| 61 | 334 | 5.3 | 10.1 | 3.9 |
| 62 | 337 | 6.5 | 11.6 | 4.6 |
| 63 | 338 | 3.6 | 10.0 | 3.7 |
| 64 | 352 | 4.5 | 9.0 | 5.1 |
| 65 | 359 | 5.5 | 7.1 | 4.5 |
| 66 | 365 | 6.5 | 9.9 | 4.5 |
| 67 | 366 | 6.5 | 11.6 | 4.5 |
| 68 | 369 | 6.6 | 11.2 | 6.5 |
| 69 | 374 | 6.5 | 14.2 | 6.5 |
| 70 | 376 | 4.9 | 16.2 | 6.5 |
| 71 | 379 | 6.2 | 9.0 | 6.2 |
| 72 | 387 | 5.3 | 6.4 | 2.8 |
| 73 | 389 | 3.8 | 8.9 | 4.0 |
| 74 | 396 | 4.4 | 9.2 | 6.5 |
| 75 | 399 | 5.0 | 5.2 | 3.5 |
| 76 | 401 | 6.1 | 3.5 | 3.5 |
| 77 | 404 | 5.5 | 14.7 | 5.5 |
| 78 | 406 | 6.4 | 6.1 | 3.9 |
| 79 | 409 | 5.4 | 10.1 | 3.4 |
| 80 | 415 | 4.9 | 4.5 | 1.9 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 81 | 417 | 5.5 | 10.0 | 3.7 |
| 82 | 419 | 4.3 | 8.1 | 2.5 |
| 83 | 422 | 5.5 | 10.6 | 3.7 |
| 84 | 427 | 4.3 | 8.2 | 4.1 |
| 85 | 435 | 4.5 | 11.0 | 3.5 |
| 86 | 438 | 5.5 | 6.8 | 5.1 |
| 87 | 441 | 6.2 | 11.7 | 5.1 |
| 88 | 442 | 3.5 | 3.9 | 3.0 |
| 89 | 450 | 5.6 | 10.9 | 3.6 |
| 90 | 461 | 5.1 | 4.5 | 4.2 |
| 91 | 464 | 5.5 | 12.3 | 5.7 |
| 92 | 469 | 5.5 | 11.0 | 6.3 |
| 93 | 470 | 5.0 | 10.5 | 3.9 |
| 94 | 473 | 5.5 | 12.6 | 5.5 |
| 95 | 476 | 5.1 | 12.4 | 5.0 |
| 96 | 480 | 5.7 | 7.0 | 4.5 |
| 97 | 482 | 5.5 | 8.3 | 4.3 |
| 98 | 491 | 5.1 | 11.6 | 4.7 |
| 99 | 496 | 5.5 | 10.0 | 4.1 |
| 100 | 505 | 6.0 | 10.5 | 2.0 |
| 101 | 506 | 6.8 | 10.0 | 4.4 |
| 102 | 507 | 6.8 | 11.4 | 3.9 |
| 103 | 516 | 6.6 | 14.5 | 6.4 |
| 104 | 520 | 5.4 | 11.3 | 5.7 |
| 105 | 522 | 5.6 | 4.7 | 3.7 |
| 106 | 527 | 5.9 | 10.4 | 6.0 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 107 | 530 | 4.9 | 11.0 | 4.9 |
| 108 | 533 | 5.4 | 11.1 | 6.0 |
| 109 | 537 | 5.6 | 10.5 | 3.9 |
| 110 | 545 | 5.4 | 12.1 | 4.5 |
| 111 | 561 | 5.6 | 10.0 | 4.9 |
| 112 | 565 | 4.5 | 10.2 | 3.9 |
| 113 | 568 | 5.6 | 5.6 | 4.5 |
| 114 | 587 | 5.9 | 10.1 | 3.9 |
| 115 | 612 | 6.6 | 10.9 | 5.1 |
| 116 | 617 | 5.4 | 11.3 | 5.4 |
| 117 | 625 | 6.6 | 11.2 | 4.4 |
| 118 | 626 | 5.6 | 11.9 | 4.6 |
| 119 | 628 | 5.4 | 10.7 | 3.4 |
| 120 | 647 | 5.8 | 11.4 | 5.1 |
| 121 | 662 | 5.3 | 12.8 | 5.1 |
| 122 | 666 | 5.5 | 10.5 | 3.5 |
| 123 | 667 | 5.6 | 8.5 | 5.1 |
| 124 | 672 | 6.5 | 13.7 | 5.0 |
| 125 | 674 | 4.6 | 7.7 | 3.7 |
| 126 | 675 | 10.0 | 18.0 | 6.3 |
| 127 | 677 | 8.4 | 11.8 | 3.9 |
| 128 | 678 | 5.4 | 10.3 | 3.8 |
| 129 | 681 | 6.0 | 8.3 | 5.5 |
| 130 | 682 | 8.0 | 19.9 | 6.9 |
| 131 | 692 | 5.0 | 10.5 | 5.5 |
| 132 | 699 | 8.1 | 14.2 | 7.5 |
| 133 | 704 | 5.5 | 7.4 | 5.4 |
| 134 | 706 | 6.1 | 4.9 | 2.3 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 135 | 712 | 8.12 | 15.9 | 6.8 |
| 136 | 725 | 4.5 | 14.4 | 6.0 |
| 137 | 727 | 5.3 | 6.4 | 2.8 |
| 138 | 736 | 6.1 | 10.5 | 3.5 |
| 139 | 739 | 4.5 | 9.1 | 7.7 |
| 140 | 742 | 5.0 | 4.9 | 2.5 |
| 141 | 745 | 6.1 | 3.6 | 3.3 |
| 142 | 748 | 6.5 | 17.0 | 5.5 |
| 143 | 753 | 6.2 | 9.2 | 6.3 |
| 144 | 757 | 5.1 | 10.4 | 3.0 |
| 145 | 760 | 5.3 | 13.7 | 5.7 |
| 146 | 769 | 6.8 | 9.7 | 4.5 |
| 147 | 784 | 6.8 | 10.0 | 4.4 |
| 148 | 787 | 5.9 | 9.3 | 3.5 |
| 149 | 797 | 6.5 | 11.1 | 4.3 |
| 150 | 800 | 5.3 | 9.5 | 3.1 |
| 151 | 807 | 4.3 | 4.1 | 1.0 |
| 152 | 809 | 5.7 | 9.7 | 3.7 |
| 153 | 815 | 3.4 | 9.7 | 3.0 |
| 154 | 821 | 3.3 | 6.8 | 3.9 |
| 155 | 822 | 4.0 | 11.4 | 6.2 |
| 156 | 837 | 3.9 | 4.6 | 1.7 |
| 157 | 838 | 3.8 | 11.1 | 3.9 |
| 158 | 844 | 3.7 | 4.2 | 5.1 |
| 159 | 853 | 7.3 | 10.4 | 6.0 |
| 160 | 857 | 5.3 | 9.1 | 4.9 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 161 | 858 | 5.1 | 10.6 | 4.7 |
| 162 | 859 | 3.5 | 5.5 | 3.3 |
| 163 | 860 | 6.5 | 5.6 | 4.0 |
| 164 | 861 | 3.2 | 8.7 | 3.2 |
| 165 | 862 | 3.5 | 10.5 | 3.1 |
| 166 | 864 | 5.7 | 11.2 | 4.3 |
| 167 | 865 | 6.0 | 9.0 | 5.1 |
| 168 | 868 | 5.0 | 7.1 | 4.5 |
| 169 | 871 | 6.0 | 10.3 | 6.6 |
| 170 | 875 | 5.0 | 8.7 | 3.0 |
| 171 | 878 | 5.5 | 11.7 | 3.7 |
| 172 | 879 | 5.8 | 11.4 | 3.9 |
| 173 | 882 | 5.3 | 14.0 | 3.7 |
| 174 | 883 | 5.9 | 11.0 | 5.1 |
| 175 | 896 | 5.9 | 10.7 | 5.5 |
| 176 | 898 | 4.3 | 5.0 | 3.1 |
| 177 | 899 | 6.8 | 15.0 | 5.0 |
| 178 | 904 | 5.5 | 11.8 | 4.9 |
| 179 | 906 | 10.3 | 7.0 | 4.5 |
| 180 | 907 | 7.3 | 10.5 | 4.5 |
| 181 | 915 | 5.2 | 13.0 | 4.9 |
| 182 | 919 | 5.5 | 9.4 | 3.5 |
| 183 | 920 | 5.5 | 10.4 | 3.5 |
| 184 | 921 | 5.6 | 8.3 | 4.9 |
| 185 | 927 | 6.2 | 12.4 | 4.0 |
| 186 | 928 | 6.0 | 12.8 | 4.1 |

# APPENDIX – G (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 187 | 931 | 8.4 | 8.5 | 3.5 |
| 188 | 940 | 5.9 | 8.5 | 4.9 |
| 189 | 942 | 7.9 | 15.0 | 5.3 |
| 190 | 943 | 6.8 | 15.0 | 5.5 |
| 191 | 951 | 5.5 | 12.1 | 5.2 |
| 192 | 959 | 5.3 | 9.8 | 4.6 |
| 193 | 968 | 7.4 | 14.9 | 5.0 |
| 194 | 969 | 5.5 | 12.1 | 4.4 |
| 195 | 980 | 4.9 | 4.5 | 4.4 |
| 196 | 981 | 5.3 | 10.3 | 4.1 |
| 197 | 983 | 6.1 | 7.1 | 2.0 |
| 198 | 988 | 5.3 | 12.6 | 4.5 |
| 199 | 991 | 4.8 | 13.8 | 4.5 |
| 200 | 993 | 5.0 | 7.0 | 4.1 |
| 201 | 1003 | 8.9 | 17.2 | 6.5 |

# APPENDIX - H

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (161-165 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 25 | 4.5 | 10.6 | 5.6 |
| 02 | 40 | 6.8 | 9.5 | 5.0 |
| 03 | 42 | 6.7 | 10.4 | 5.1 |
| 04 | 113 | 7.5 | 9.9 | 4.9 |
| 05 | 145 | 3.9 | 9.1 | 4.5 |
| 06 | 169 | 6.3 | 15.8 | 6.5 |
| 07 | 171 | 4.9 | 12.1 | 5.5 |
| 08 | 174 | 3.5 | 4.2 | 3.7 |
| 09 | 178 | 4.5 | 9.3 | 5.0 |
| 10 | 186 | 7.8 | 10.2 | 5.2 |
| 11 | 196 | 6.0 | 10.1 | 5.1 |
| 12 | 201 | 6.3 | 15.2 | 6.5 |
| 13 | 204 | 3.8 | 9.3 | 4.0 |
| 14 | 205 | 5.0 | 6.4 | 5.0 |
| 15 | 210 | 4.2 | 9.3 | 4.0 |
| 16 | 213 | 3.5 | 5.2 | 4.7 |
| 17 | 214 | 6.1 | 11.4 | 5.7 |
| 18 | 224 | 9.6 | 19.3 | 7.5 |
| 19 | 228 | 7.0 | 7.4 | 1.5 |
| 20 | 230 | 5.1 | 21.0 | 7.5 |
| 21 | 240 | 4.5 | 9.2 | 5.0 |
| 22 | 246 | 5.3 | 11.5 | 4.0 |

# APPENDIX – H (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 23 | 261 | 4.5 | 11.8 | 3.5 |
| 24 | 265 | 5.1 | 10.6 | 5.2 |
| 25 | 268 | 5.5 | 10.3 | 5.2 |
| 26 | 271 | 5.3 | 14.4 | 6.1 |
| 27 | 302 | 5.5 | 10.3 | 5.2 |
| 28 | 306 | 5.3 | 9.4 | 4.3 |
| 29 | 316 | 5.4 | 9.7 | 5.3 |
| 30 | 322 | 6.0 | 9.7 | 5.6 |
| 31 | 326 | 5.1 | 13.4 | 3.1 |
| 32 | 327 | 5.2 | 13.6 | 3.9 |
| 33 | 335 | 3.5 | 9.4 | 5.0 |
| 34 | 341 | 6.9 | 12.7 | 5.1 |
| 35 | 343 | 6.3 | 6.3 | 5.1 |
| 36 | 344 | 3.6 | 7.2 | 4.1 |
| 37 | 347 | 4.6 | 10.0 | 5.6 |
| 38 | 353 | 4.5 | 4.0 | 4.5 |
| 39 | 356 | 6.2 | 15.0 | 6.5 |
| 40 | 361 | 6.5 | 10.2 | 5.1 |
| 41 | 362 | 4.5 | 10.9 | 5.5 |
| 42 | 368 | 6.5 | 9.8 | 5.2 |
| 43 | 373 | 6.5 | 10.1 | 5.2 |
| 44 | 385 | 3.5 | 4.1 | 3.7 |
| 45 | 390 | 5.5 | 8.2 | 4.5 |
| 46 | 392 | 6.5 | 8.4 | 6.3 |
| 47 | 394 | 6.0 | 11.1 | 3.5 |
| 48 | 424 | 6.8 | 12.0 | 4.6 |
| 49 | 426 | 6.6 | 6.0 | 5.2 |
| 50 | 428 | 5.0 | 10.2 | 6.0 |

# APPENDIX – H (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 51 | 433 | 5.3 | 12.3 | 3.7 |
| 52 | 440 | 6.5 | 9.9 | 5.4 |
| 53 | 467 | 4.2 | 9.5 | 4.7 |
| 54 | 478 | 5.1 | 9.8 | 6.1 |
| 55 | 483 | 5.6 | 12.4 | 4.4 |
| 56 | 486 | 6.2 | 17.0 | 5.1 |
| 57 | 510 | 5.6 | 12.5 | 7.3 |
| 58 | 512 | 6.1 | 8.7 | 5.4 |
| 59 | 514 | 7.1 | 17.2 | 5.5 |
| 60 | 534 | 3.9 | 5.9 | 4.7 |
| 61 | 535 | 6.5 | 5.7 | 5.1 |
| 62 | 536 | 6.7 | 11.5 | 5.1 |
| 63 | 556 | 5.6 | 12.3 | 5.3 |
| 64 | 559 | 5.7 | 11.1 | 5.0 |
| 65 | 563 | 4.9 | 11.2 | 5.7 |
| 66 | 566 | 6.5 | 4.8 | 4.3 |
| 67 | 585 | 4.7 | 11.6 | 4.4 |
| 68 | 588 | 4.9 | 12.5 | 5.2 |
| 69 | 593 | 5.8 | 10.7 | 5.0 |
| 70 | 601 | 5.1 | 10.2 | 4.5 |
| 71 | 606 | 4.6 | 7.7 | 4.9 |
| 72 | 608 | 5.7 | 10.9 | 5.0 |
| 73 | 613 | 6.0 | 11.8 | 5.2 |
| 74 | 661 | 5.5 | 9.3 | 4.8 |
| 75 | 669 | 6.5 | 13.8 | 5.1 |
| 76 | 676 | 8.0 | 11.0 | 5.5 |
| 77 | 679 | 3.5 | 7.5 | 5.8 |
| 78 | 683 | 5.1 | 13.5 | 6.5 |

# APPENDIX – H (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 79 | 687 | 6.6 | 16.7 | 6.6 |
| 80 | 690 | 7.2 | 7.4 | 1.7 |
| 81 | 691 | 5.6 | 12.0 | 3.8 |
| 82 | 693 | 9.3 | 20.5 | 7.9 |
| 83 | 695 | 7.3 | 10.5 | 6.0 |
| 84 | 702 | 8.5 | 11.5 | 5.0 |
| 85 | 708 | 5.4 | 11.4 | 5.7 |
| 86 | 716 | 6.8 | 7.9 | 4.7 |
| 87 | 718 | 5.4 | 13.3 | 8.2 |
| 88 | 723 | 3.4 | 4.2 | 3.7 |
| 89 | 724 | 3.5 | 11.0 | 3.5 |
| 90 | 729 | 3.8 | 9.1 | 4.0 |
| 91 | 730 | 5.5 | 8.1 | 4.5 |
| 92 | 731 | 5.5 | 9.1 | 4.4 |
| 93 | 735 | 6.0 | 10.7 | 3.6 |
| 94 | 763 | 3.9 | 9.4 | 4.5 |
| 95 | 765 | 4.5 | 9.6 | 8.3 |
| 96 | 766 | 6.0 | 10.4 | 2.0 |
| 97 | 770 | 6.0 | 7.8 | 5.9 |
| 98 | 773 | 5.4 | 7.2 | 6.0 |
| 99 | 785 | 4.6 | 11.0 | 3.3 |
| 100 | 788 | 4.8 | 13.9 | 2.8 |
| 101 | 789 | 4.9 | 13.6 | 3.5 |
| 102 | 794 | 5.8 | 9.4 | 5.7 |
| 103 | 818 | 7.2 | 12.3 | 4.4 |
| 104 | 820 | 6.5 | 5.5 | 5.3 |

# APPENDIX – H (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 105 | 825 | 4.7 | 11.9 | 6.4 |
| 106 | 842 | 6.0 | 13.1 | 7.3 |
| 107 | 843 | 6.2 | 11.5 | 5.1 |
| 108 | 852 | 5.4 | 12.5 | 7.6 |
| 109 | 881 | 3.5 | 9.4 | 4.1 |
| 110 | 884 | 5.4 | 11.4 | 6.0 |
| 111 | 887 | 3.5 | 9.3 | 4.9 |
| 112 | 894 | 6.0 | 14.2 | 5.8 |
| 113 | 897 | 6.5 | 16.0 | 4.5 |
| 114 | 910 | 8.3 | 12.5 | 4.5 |
| 115 | 911 | 7.3 | 11.5 | 4.5 |
| 116 | 912 | 6.1 | 12.4 | 4.4 |
| 117 | 913 | 5.2 | 13.5 | 5.0 |
| 118 | 914 | 5.3 | 8.1 | 4.3 |
| 119 | 918 | 6.3 | 21.9 | 9.9 |
| 120 | 923 | 6.5 | 13.8 | 5.1 |
| 121 | 933 | 4.3 | 6.9 | 5.8 |
| 122 | 934 | 4.9 | 12.8 | 4.0 |
| 123 | 935 | 5.5 | 13.2 | 6.5 |
| 124 | 937 | 4.8 | 9.9 | 6.1 |
| 125 | 944 | 7.8 | 10.2 | 5.2 |
| 126 | 947 | 5.0 | 12.0 | 5.4 |
| 127 | 970 | 6.3 | 15.6 | 6.5 |
| 128 | 973 | 6.3 | 15.7 | 6.5 |
| 129 | 978 | 5.3 | 10.8 | 4.0 |
| 130 | 982 | 5.5 | 10.2 | 5.0 |
| 131 | 984 | 6.1 | 15.1 | 5.5 |
| 132 | 987 | 5.5 | 10.1 | 5.1 |

# APPENDIX - I

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (166-170 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 49 | 5.0 | 6.2 | 6.3 |
| 02 | 140 | 7.1 | 11.8 | 6.5 |
| 03 | 141 | 4.3 | 5.6 | 4.9 |
| 04 | 143 | 6.5 | 11.3 | 4.5 |
| 05 | 156 | 6.3 | 11.0 | 5.9 |
| 06 | 162 | 4.1 | 11.7 | 5.0 |
| 07 | 163 | 4.1 | 11.1 | 4.7 |
| 08 | 166 | 6.3 | 11.4 | 4.4 |
| 09 | 170 | 8.5 | 11.5 | 5.2 |
| 10 | 175 | 6.0 | 6.6 | 6.4 |
| 11 | 181 | 6.3 | 13.2 | 7.2 |
| 12 | 182 | 6.5 | 11.2 | 4.5 |
| 13 | 195 | 4.5 | 11.1 | 5.5 |
| 14 | 197 | 6.6 | 7.2 | 5.5 |
| 15 | 209 | 5.0 | 6.3 | 5.0 |
| 16 | 216 | 7.0 | 8.7 | 4.5 |
| 17 | 217 | 6.6 | 8.0 | 5.5 |
| 18 | 225 | 6.0 | 6.2 | 3.5 |
| 19 | 235 | 7.0 | 12.0 | 6.5 |
| 20 | 238 | 6.2 | 11.7 | 4.5 |
| 21 | 249 | 6.5 | 11.0 | 6.0 |
| 22 | 255 | 4.2 | 11.1 | 4.5 |
| 23 | 256 | 4.5 | 12.3 | 5.5 |
| 24 | 258 | 5.1 | 8.1 | 5.3 |
| 25 | 259 | 5.5 | 6.1 | 5.1 |

# APPENDIX – I (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 26 | 283 | 5.5 | 10.5 | 5.0 |
| 27 | 284 | 6.0 | 8.3 | 5.5 |
| 28 | 285 | 6.1 | 6.5 | 5.9 |
| 29 | 303 | 6.7 | 11.6 | 6.0 |
| 30 | 309 | 5.7 | 7.4 | 3.5 |
| 31 | 310 | 4.5 | 12.1 | 5.2 |
| 32 | 318 | 6.0 | 13.6 | 6.0 |
| 33 | 319 | 5.9 | 9.9 | 4.9 |
| 34 | 320 | 7.1 | 6.9 | 5.4 |
| 35 | 332 | 6.3 | 12.9 | 5.9 |
| 36 | 333 | 6.5 | 13.9 | 6.2 |
| 37 | 336 | 5.3 | 12.5 | 6.1 |
| 38 | 345 | 6.5 | 13.1 | 6.7 |
| 39 | 360 | 6.5 | 7.5 | 5.5 |
| 40 | 370 | 5.2 | 8.5 | 4.5 |
| 41 | 381 | 5.5 | 9.0 | 5.5 |
| 42 | 402 | 5.0 | 6.6 | 5.0 |
| 43 | 408 | 3.9 | 10.3 | 5.3 |
| 44 | 410 | 6.7 | 14.0 | 6.1 |
| 45 | 411 | 6.0 | 13.5 | 5.7 |
| 46 | 429 | 6.5 | 12.5 | 5.9 |
| 47 | 431 | 5.1 | 11.5 | 5.8 |
| 48 | 443 | 5.0 | 6.7 | 5.9 |
| 49 | 463 | 6.3 | 12.5 | 6.0 |
| 50 | 465 | 6.0 | 11.2 | 4.3 |
| 51 | 472 | 6.5 | 10.9 | 3.7 |
| 52 | 475 | 5.2 | 11.9 | 4.7 |

# APPENDIX – I (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 53 | 481 | 6.9 | 13.1 | 5.5 |
| 54 | 504 | 5.3 | 13.8 | 3.3 |
| 55 | 811 | 5.9 | 11.1 | 3.7 |
| 56 | 813 | 7.0 | 8.7 | 4.5 |
| 57 | 817 | 5.1 | 11.0 | 5.5 |
| 58 | 518 | 6.6 | 8.3 | 5.5 |
| 59 | 519 | 4.5 | 7.4 | 5.0 |
| 60 | 523 | 5.8 | 5.5 | 5.1 |
| 61 | 524 | 6.2 | 12.5 | 5.7 |
| 62 | 532 | 6.1 | 11.9 | 6.7 |
| 63 | 558 | 6.5 | 12.5 | 5.5 |
| 64 | 560 | 6.2 | 12.0 | 5.5 |
| 65 | 564 | 5.5 | 8.1 | 4.5 |
| 66 | 569 | 6.8 | 9.8 | 5.0 |
| 67 | 598 | 7.5 | 11.8 | 5.1 |
| 68 | 600 | 7.1 | 11.7 | 3.1 |
| 69 | 603 | 6.1 | 11.0 | 5.1 |
| 70 | 607 | 4.5 | 12.0 | 5.4 |
| 71 | 609 | 6.0 | 10.6 | 3.5 |
| 72 | 611 | 5.5 | 10.5 | 5.4 |
| 73 | 614 | 4.0 | 11.4 | 6.0 |
| 74 | 616 | 5.4 | 11.6 | 5.9 |
| 75 | 627 | 6.0 | 10.4 | 5.0 |
| 76 | 629 | 6.2 | 11.1 | 5.5 |
| 77 | 660 | 6.5 | 10.1 | 4.9 |
| 78 | 665 | 6.4 | 15.8 | 5.0 |
| 79 | 670 | 7.5 | 11.1 | 6.9 |
| 80 | 671 | 5.5 | 12.7 | 6.6 |

# APPENDIX – I (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 81 | 680 | 4.4 | 5.5 | 4.5 |
| 82 | 685 | 5.4 | 7.1 | 6.0 |
| 83 | 689 | 5.4 | 17.0 | 6.7 |
| 84 | 700 | 6.7 | 11.0 | 6.5 |
| 85 | 703 | 7.1 | 11.8 | 5.1 |
| 86 | 705 | 8.0 | 6.1 | 5.3 |
| 87 | 709 | 4.5 | 7.3 | 4.9 |
| 88 | 710 | 6.6 | 7.0 | 5.5 |
| 89 | 711 | 7.9 | 12.3 | 5.4 |
| 90 | 714 | 8.7 | 17.4 | 6.4 |
| 91 | 715 | 7.0 | 8.5 | 4.4 |
| 92 | 717 | 6.0 | 6.1 | 3.0 |
| 93 | 733 | 6.4 | 8.2 | 6.4 |
| 94 | 746 | 5.0 | 6.4 | 5.0 |
| 95 | 749 | 7.0 | 5.9 | 5.8 |
| 96 | 756 | 7.0 | 13.5 | 3.0 |
| 97 | 759 | 4.5 | 5.8 | 5.0 |
| 98 | 764 | 4.0 | 7.0 | 5.3 |
| 99 | 768 | 5.5 | 4.6 | 2.9 |
| 100 | 771 | 3.7 | 8.5 | 6.1 |
| 101 | 780 | 7.1 | 16.2 | 5.9 |
| 102 | 796 | 6.9 | 5.1 | 5.7 |
| 103 | 798 | 5.2 | 13.1 | 6.7 |
| 104 | 799 | 3.6 | 9.4 | 5.0 |
| 105 | 801 | 6.4 | 13.7 | 6.5 |
| 106 | 802 | 6.1 | 13.1 | 6.0 |

# APPENDIX – I (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 107 | 823 | 6.4 | 12.9 | 6.8 |
| 108 | 849 | 6.3 | 13.2 | 6.4 |
| 109 | 867 | 6.5 | 11.3 | 4.3 |
| 110 | 872 | 7.3 | 18.2 | 6.5 |
| 111 | 873 | 6.5 | 11.4 | 4.3 |
| 112 | 874 | 7.3 | 19.5 | 9.5 |
| 113 | 877 | 4.2 | 8.7 | 5.5 |
| 114 | 880 | 7.0 | 7.3 | 5.3 |
| 115 | 885 | 6.7 | 11.0 | 6.5 |
| 116 | 886 | 7.5 | 6.1 | 3.9 |
| 117 | 888 | 4.3 | 5.3 | 4.9 |
| 118 | 890 | 6.9 | 16.4 | 4.5 |
| 119 | 895 | 7.0 | 16.9 | 4.9 |
| 120 | 903 | 6.8 | 15.0 | 8.0 |
| 121 | 905 | 7.9 | 14.2 | 7.9 |
| 122 | 924 | 6.0 | 12.9 | 6.3 |
| 123 | 925 | 7.9 | 12.7 | 7.1 |
| 124 | 926 | 5.5 | 12.3 | 6.6 |
| 125 | 932 | 4.2 | 7.9 | 5.5 |
| 126 | 936 | 5.0 | 7.9 | 2.7 |
| 127 | 941 | 8.0 | 15.7 | 5.0 |
| 128 | 945 | 5.9 | 11.7 | 6.0 |
| 129 | 967 | 4.5 | 12.2 | 6.5 |
| 130 | 974 | 7.0 | 13.4 | 4.7 |
| 131 | 1001 | 6.3 | 13.6 | 6.5 |

# APPENDIX - J

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (171-175 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 139 | 8.9 | 11.0 | 6.1 |
| 02 | 144 | 6.9 | 16.2 | 6.1 |
| 03 | 153 | 6.6 | 9.5 | 4.9 |
| 04 | 154 | 8.0 | 13.5 | 6.0 |
| 05 | 164 | 6.5 | 8.5 | 5.0 |
| 06 | 177 | 7.2 | 16.1 | 6.0 |
| 07 | 194 | 7.3 | 16.1 | 6.2 |
| 08 | 200 | 7.2 | 9.6 | 4.7 |
| 09 | 208 | 6.5 | 8.3 | 4.5 |
| 10 | 218 | 6.5 | 10.0 | 5.0 |
| 11 | 218 | 7.0 | 11.8 | 4.5 |
| 12 | 234 | 7.5 | 11.0 | 6.0 |
| 13 | 236 | 5.3 | 5.5 | 5.0 |
| 14 | 239 | 6.5 | 16.2 | 6.5 |
| 15 | 247 | 6.5 | 9.5 | 5.2 |
| 16 | 254 | 7.1 | 13.9 | 6.3 |
| 17 | 286 | 6.9 | 10.9 | 4.6 |
| 18 | 287 | 7.2 | 9.0 | 5.6 |
| 19 | 304 | 8.0 | 11.4 | 6.1 |
| 20 | 315 | 6.2 | 15.4 | 6.1 |
| 21 | 350 | 6.5 | 5.1 | 5.9 |
| 22 | 357 | 7.0 | 9.2 | 4.5 |
| 23 | 363 | 7.3 | 16.0 | 6.1 |
| 24 | 382 | 5.2 | 13.1 | 5.5 |

# APPENDIX – J (continued)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 25 | 393 | 6.1 | 4.7 | 6.5 |
| 26 | 405 | 7.0 | 5.9 | 5.5 |
| 27 | 407 | 5.2 | 12.0 | 6.2 |
| 28 | 416 | 6.5 | 7.3 | 4.5 |
| 29 | 466 | 7.0 | 16.1 | 5.4 |
| 30 | 471 | 7.0 | 13.3 | 5.5 |
| 31 | 474 | 5.2 | 12.2 | 5.2 |
| 32 | 477 | 6.3 | 11.1 | 5.6 |
| 33 | 484 | 6.0 | 12.6 | 6.1 |
| 34 | 494 | 6.7 | 7.8 | 5.5 |
| 35 | 547 | 6.7 | 12.1 | 4.5 |
| 36 | 595 | 6.9 | 5.6 | 5.7 |
| 37 | 621 | 7.0 | 11.7 | 5.6 |
| 38 | 664 | 7.0 | 13.5 | 6.1 |
| 39 | 698 | 8.9 | 5.5 | 4.4 |
| 40 | 734 | 6.0 | 4.6 | 6.4 |
| 41 | 779 | 7.3 | 16.1 | 6.0 |
| 42 | 808 | 6.6 | 7.2 | 4.3 |
| 43 | 917 | 8.8 | 13.0 | 6.0 |
| 44 | 957 | 6.0 | 12.3 | 8.4 |

# APPENDIX - K

## CLASSIFICATION OF SUBJECTS ACCORDING TO HEIGHT (176-180 cms.) AND COMPUTATION OF NORM

| S. No. | Code | Cervical (cms) | Thoracic (cms) | Lumbar (cms) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 01 | 147 | 4.9 | 2.7 | 4.5 |
| 02 | 176 | 5.2 | 9.9 | 4.5 |
| 03 | 190 | 5.2 | 8.3 | 4.7 |
| 04 | 215 | 4.5 | 2.7 | 4.0 |
| 05 | 242 | 5.1 | 3.2 | 4.5 |
| 06 | 288 | 5.6 | 3.6 | 4.1 |
| 07 | 289 | 4.9 | 3.9 | 4.5 |
| 08 | 403 | 4.5 | 2.7 | 4.5 |
| 09 | 436 | 5.9 | 6.2 | 4.4 |
| 10 | 468 | 5.1 | 3.5 | 4.3 |
| 11 | 596 | 5.0 | 3.4 | 3.9 |
| 12 | 597 | 5.6 | 8.6 | 4.6 |
| 13 | 686 | 5.2 | 9.9 | 4.6 |
| 14 | 694 | 5.1 | 8.1 | 7.0 |
| 15 | 747 | 4.6 | 2.7 | 4.0 |

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